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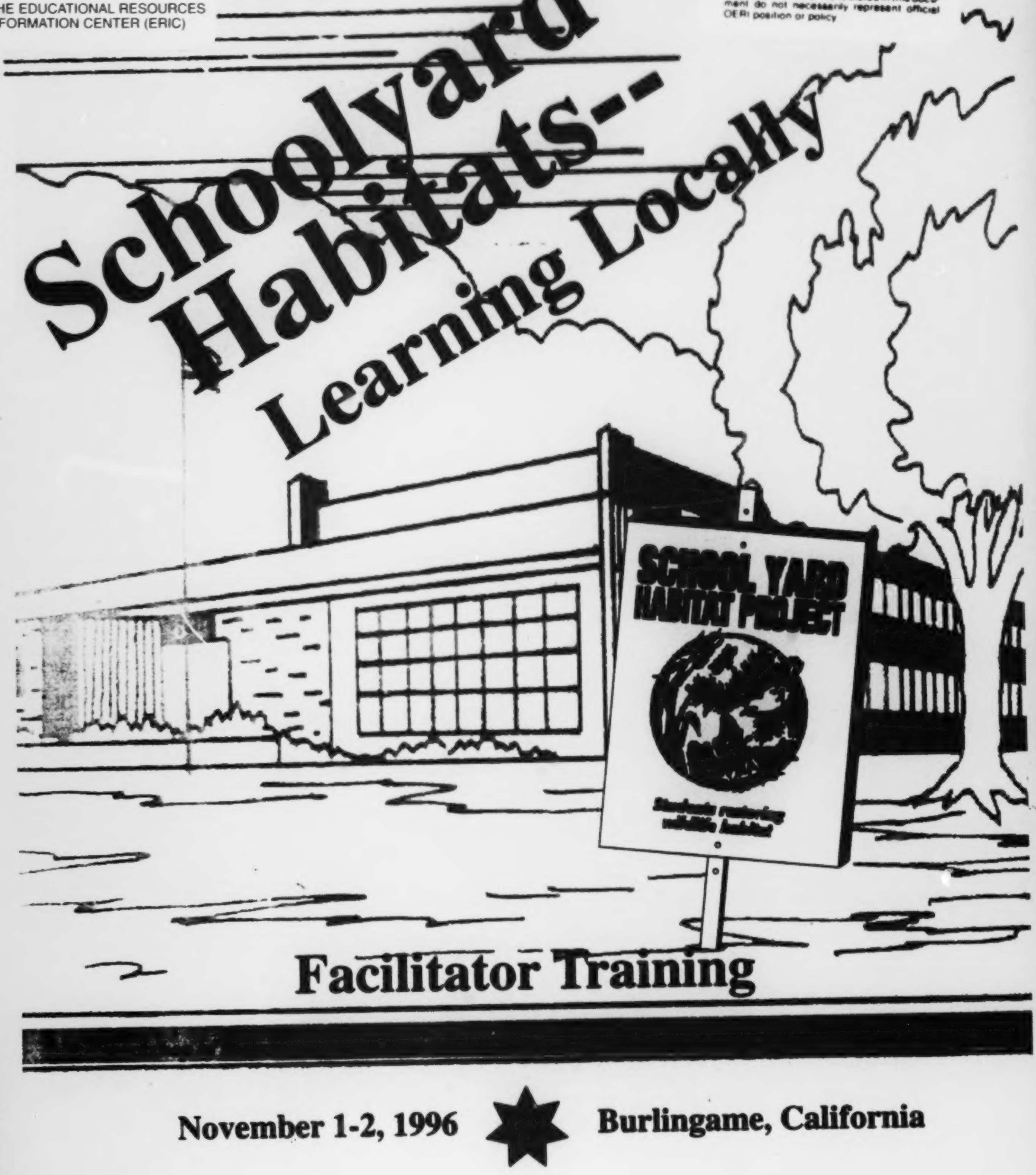
ED 403 127

Schoolyard Habitats--Learning Locally



Facilitator Training

November 1-2, 1996 ★ Burlingame, California

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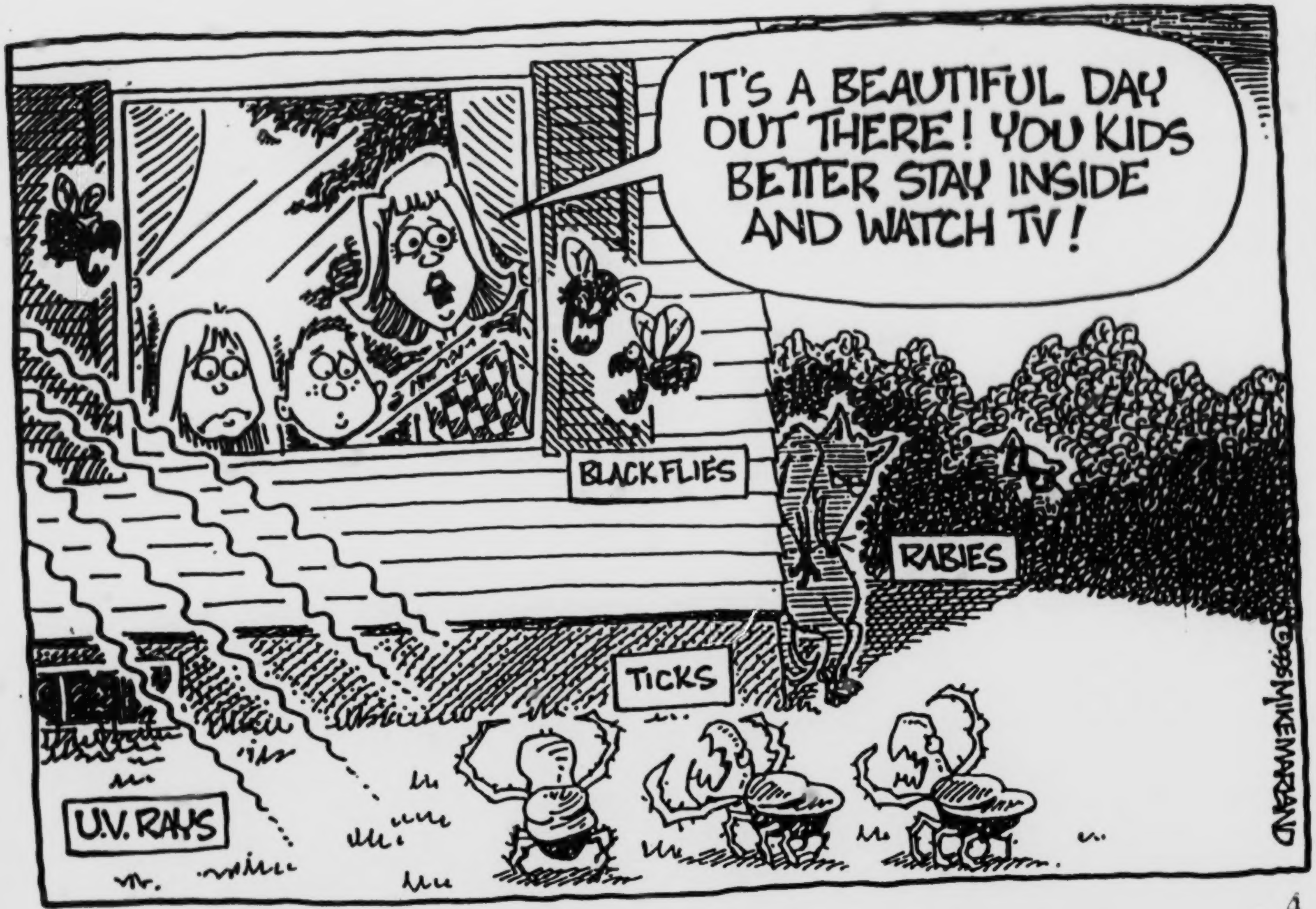
IT'S A BEAUTIFUL DAY OUT THERE! YOU KIDS BETTER STAY INSIDE AND WATCH TV!
BLACKFLIES
RABIES
TICKS
U.V. RAYS
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Schoolyard Habitats -- Learning Locally

Facilitator Training

SCHOOL YARD
HABITAT PROJECT
Students restoring
wildlife habitat

Presented by:

U.S. Fish & Wildlife Service

National Wildlife Federation

New Hampshire Fish and Game Dept.
(Project Home)

Project WILD

Sponsored by:

The National Education and
Training Center -
Division of Education

Schoolyard Habitats -- Learning Locally

National Education and Training Center (NETC)

November 1-2, 1996, Burlingame, CA

presented jointly by U.S. Fish and Wildlife Service, National Wildlife Federation, Project WILD, and Project HOME in conjunction with the North American Association for Environmental Education

Agenda and Objectives

Audience:

Educators, natural resources professionals, and others who will be working with students, teachers, school systems, youth groups and their leaders, community groups, and others to plan, design, and conduct wildlife habitat enhancement projects, primarily on school grounds. Course participants should be considering developing an education/outreach program that focuses on assisting and training schools to conduct projects, and on training other educators and resource professionals to provide similar assistance.

Course Description:

Meet the needs of teachers seeking to empower students to take action for wildlife in their communities! Learn to develop a successful schoolyard habitats program that trains teachers in enhancement techniques, provides support for schools, and derives resources from an international network.

This course will provide an introduction to planning, designing, and installing wildlife habitat projects on school grounds. Course participants will select two sample habitats to learn about and plan, including ponds and wetlands, woodlands, grasslands (meadows and prairies), and deserts. The workshop will present other components of successful programs including forming a broad-based team; site inventory and mapping techniques; managing the site for diversity; project and program evaluation; and tips on working with schools, such as involving and enabling the students, training teachers, curriculum integration, and overcoming administrative and financial challenges. It will also provide examples of real school projects and ideas for involving the community and other partners to establish a system of technical support for schools. Participants will be encouraged to develop quality schoolyard habitats programs in their own areas, with guidance from the experiences and proven successes of programs such as the U.S. Fish and Wildlife Service, National Wildlife Federation, Project WILD, and Project HOME.

Course Objectives:

Upon completion of this course participants will be able to:

- Facilitate the process of developing successful schoolyard habitat projects in a variety of settings, by providing appropriate guidance to schools and others to enable them to maximize effective student and community involvement, and to overcome various school system challenges;

- Understand and apply the key components of habitat enhancement with students on school grounds:
  - team building,
  - learning the landscape and understanding wildlife habitat requirements,
  - implementing (planning, designing, and installing) projects that are ecologically sound and beneficial to wildlife;

- Identify and access various resources for assistance in planning, designing, and completing wildlife habitat projects;

- Name and access existing programs, discuss features of effective programs, and use this knowledge to develop a schoolyard habitats program in their state or region, in urban, suburban, and rural settings.

FRIDAY, November 1, 1996

AFTERNOON/ EVENING

1:00 - 2:15 SESSION 1: **Introduction**

Craig Tufts, Chief Naturalist, Manager, Backyard Habitats Program, National Wildlife Federation will provide a brief overview of the workshop, conduct an ice-breaker activity, and introduce some of the elements involved in schoolyard habitat enhancement.

Objectives: *As a result of this session, participants will be able to:*

- Describe the objectives of the course.
- Define the term habitat and discuss the basic components of wildlife habitat.
- Name at least three habitat types that can be developed on schoolyards.
- Discuss some differences between managing a site for general biodiversity and managing for specific wildlife species.
- Identify several sources for instructional resources and technical assistance with projects.

2:15 - 3:45 SESSION 2: **Team Building**

Marilyn Wyzga, New Hampshire Dept. of Fish & Game, Project HOME Coordinator

Participants will be introduced to the basics of building a team to plan and implement schoolyard habitat projects using a student-driven approach. Case studies will be presented to illustrate various ways that teams can work together to conduct successful projects that are also beneficial learning experiences.

Objectives: *As a result of this session, participants will be able to:*

- List 3 reasons to use the team approach for school habitat projects and problem-solving.
- Discuss how to build an effective team and who should be involved.
- Describe practical partnerships for mentoring, funding, etc.

3:45 - 4:00 **Break**

4:00 - 6:30 SESSION 3: **Investigating the Schoolyard Landscape**

Rich Mason, U.S. Fish & Wildlife Service, Schoolyard Habitats Program (Maryland)
Marilyn Wyzga, New Hampshire Dept. of Fish & Game, Project HOME Coordinator

❂

Participants will be engaged in various mapping, site inventory, and wildlife survey activities to learn to assess existing site conditions and ways to improve the site's wildlife habitat diversity. Through mapping exercises, participants will be introduced to basic principles of managing land for wildlife diversity (biodiversity), as a wholistic option for habitat or ecosystem enhancement.

Objectives: *As a result of this session, participants will be able to:*

- Demonstrate at least one technique to use with students to map the school site.
- Conduct a site inventory and wildlife value survey with students on school grounds, and use results for project planning; apply these activities as a tool for exploring schoolyards.
- Describe wildlife needs and suggest ways the schoolyard can be improved to meet them, including addressing site-specific concerns (eg, urban settings, small properties, etc.).
- Develop a long term enhancement plan for the entire school site.
- Plan ways to evaluate the habitat project(s) based on the initial site/ wildlife survey.

6:30 - 7:00 **Wrap Up/** *logistics for Saturday will be covered*

❂ *= sessions with an outdoor component*

SATURDAY, November 2, 1996

MORNING

8:00 - 8:30 Overview/ Logistics for the day

(8:30 - 3:00) SESSION 4: **Habitat Project Development (2 sessions)**
Coordinated by Rich Mason, U.S. Fish & Wildlife Service, Schoolyard Habitats Program

○

A variety of presenters will introduce the process of planning and designing schoolyard habitat projects, for use with student involvement throughout all phases. Participants will learn about two selected habitat types and develop a planting design for each based on observed site conditions (sun, soil, moisture). Sample projects will be presented to spark ideas, and instructors will provide resources for plant selection based on geographic regions. Sources for technical assistance, teacher training, general funding ideas, and instructional resources will be provided.

Objectives: *As a result of this session, participants will be able to:*

- Describe features of two habitats, list five species of wildlife that use each habitat and name one food source for each species (all are considerations for project design).
- List the basic components of and considerations for planning a specific habitat project.
- Apply with students the process of planning, designing, and constructing habitat projects.
- Apply principles of long term management and maintenance of schoolyard habitats.
- Name at least three resources for technical assistance in their local area or region.

8:30 - 11:30 SESSION 4A: **Wetlands OR Woodlands (concurrent sessions, participants select one)**
[a short break will occur during the session at instructor's discretion]

Wetlands
Rich Mason, U.S. Fish & Wildlife Service, Schoolyard Habitats Program (Maryland)

Participants will be introduced to the basics involved with designing and constructing a schoolyard wetland, and they will learn how students can survey and identify a potential wetland creation site. Sample projects will be shared as a short slide presentation. Participants will complete a planting plan for a sample wetland project.

Objectives: *In addition to those outlined for Session 4, participants will also be able to:*

- Discuss the basics of design and grading specific to wetlands projects, for use in working with engineers for project construction.
- Select wetland plants appropriate to conditions in the finished habitat, specifically soil type and moisture regimes.

Woodlands
Craig Tufts, Chief Naturalist, Mgr. Backyard Habitats Program, National Wildlife Federation

This session will present features common to forest habitats, and introduce some of the different types of forest communities. Participants will learn about and practice designing small woodland projects appropriate for schoolyards, including selecting plants to recreate forest layers and provide year round food and cover sources for wildlife.

11:30 - 12:30 **Lunch**, on your own

○ = *sessions with an outdoor component*

AFTERNOON

12:30 - 3:00 SESSION 4B: **Grasslands OR Deserts (concurrent sessions, participants select one)**

Grasslands
Molly Fifield Murray, University of Wisconsin-Madison Arboretum, Earth Partnership
Cheryl Haberman, University of Wisconsin-Madison Arboretum, Earth Partnership
Britt Slattery, U.S. Fish & Wildlife Service, Schoolyard Habitats Program (assistance)

The basics of planning, site preparation, plant selection, installation, and management will be presented. Participants will learn the differences between prairies and eastern meadows, and will be introduced to plants found in these habitats. The use of prepared seed mixes or custom native plant mixes will be discussed, and sources for plant materials will be provided.

Deserts
Kevin Holladay, New Mexico Dept. of Game & Fish, Schoolyard Wildlife Habitat Prog.

A brief overview of the plants and animals in the Great Basin, Sonoran, Chihuahuan, and Mojave deserts will be presented. The session will concentrate on developing a design plan for an actual area with which participants are familiar, including site selection and preparation, plant selection, and maintaining and monitoring the site. Concepts of permaculture as it relates to restoring dryland ecosystems will also be covered.

3:00 - 3:20 **Break**, light refreshments

3:20 - 4:40 SESSION 5: **Developing a Schoolyard Habitats Program**
Betty Olivolo, Director, Project WILD National Office
Jeff Rucks, Colorado Division of Wildlife, Project WILD Coordinator
Karen Van Norman, Director, Minnesota School Nature Area Project (SNAP)
Marilyn Wyzga, New Hampshire Dept. of Fish & Game, Project HOME Coordinator

Participants will learn about various successful model programs that involve students and the community, offer teacher training and technical assistance, utilize partnerships for support and funding, integrate curriculum components, and evaluate individual projects and the program as a whole. Some common barriers to implementing projects will be presented and the group will discuss suggested solutions.

Objectives: *As a result of this session, participants will be able to:*

- Describe three important features of a successful schoolyard habitats program and discuss how they enhance the outcomes of the program.
- List components they would include in a schoolyard habitats program for their area and discuss ways to implement them.
- Anticipate some of the realities of developing schoolyard habitats programs and conducting projects, and describe ways to overcome possible barriers.
- Identify one source for information on their state's learning requirements or standards.
- Develop ideas for evaluating programs throughout the process, from genesis to results!

4:40 - 5:00 **Closing**
Britt Slattery, U.S. Fish and Wildlife Service, Schoolyard Habitats Program

Participants will test their new knowledge and skill for fun and prizes. Leave the workshop energized and ready to start new, exciting schoolyard habitats programs and projects with students all over the map!

WORKSHOP PRESENTERS

Course Planning Team and Instructors

Diane Davis, Project Manager
Project WILD National Office
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URL: http://eelink.umich.edu/wild/

DIANE DAVIS manages Project WILD's "WILD in the City" initiative. She has twelve years of experience in international conservation and environmental issues, national environmental policy, and local planning activities; and holds a masters degree in Environmental and Resource Policy. Before coming to Project WILD, she worked at USEPA striving for greater protection of the environment for communities nationwide.

Sara Griffen, Schoolyard Habitats Prog.
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URL: http://www.nwf.org/prog/habitats

SARA GRIFFEN, a Natural Resource major at Cornell University,received her Bachelor of Science in May 1995. Since graduation her work with community outreach and education organizations has taken her from Cambridge, MA where whe was exposed to environmental dispute resolution at the Consensus Building Institute to Fairbanks, AK where she organized community round table discussions bringing together disparate points of view focusing on the regional forest issue. Currently the Assistant Coordinator for NWF's Schoolyard Habitats program, Sara has been involved in developing and coordinating this new program since January 1996.

Rich Mason, Schoolyard Habitats Prog.
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
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email: rich_d_mason@mail.fws.gov

RICH MASON has worked for the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office since 1989 as a biologist and education specialist. He currently coordinates the Schoolyard Habitats Program and provides teacher training, curriculum development, and technical assistance for habitat projects. Rich has a Bachelor of Science degree from Frostburg State University; from 1986-1989 he ran an environmental education field center for the Chesapeake Bay Foundation on an island in the lower Chesapeake Bay. Rich enjoys many different activities including canoeing, fishing, crabbing, bird watching, playing softball and other outdoor activities and sports. He is excited about being involved with the international push towards changing the status quo of barren school landscapes into sites where students can discover and learn about the natural world.

Betty Olivolo, Director
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URL: http://eelink.umich.edu/wild/

BETTY OLIVOLO is National Director of Project WILD, a K-12 conservation and environmental education program emphasizing wildlife. Betty coordinates the Project WILD Action Grant program, which in 1993 provided seed money to help 25 states develop sustainable statewide structures for offering grants to educators, students, and schools. Betty has also coordinated science leadership institutes for administrators, curriculum specialists, teachers, and scientists at the National Science Resources Center, a collaborative effort of the Smithsonian Institution and the National Academy of Sciences. She worked for eight years at the National Wildlife Federation where she managed the NatureScope series national training program, and served as Project Coordinator for National Wildlife Week. Betty was also a classroom teacher for ten years.

Britt Slattery, BayScapes Program/
Schoolyard Habitats Program
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email: britt_slattery@mail.fws.gov

BRITT SLATTERY has been an educator for 11 years, and with the U.S. Fish and Wildlife Service for six of them -- for the National Education and Training Center, and for the Chesapeake Bay Field Office where she is currently the BayScapes program coordinator. Britt has also been a naturalist at the Cape Cod Museum of Natural History, education specialist at the National Aquarium In Baltimore, and Assistant Director of Education at Environmental Concern, Inc., a wetlands consulting firm. The two instructional guides she authored and illustrated (*WOW!: The Wonders Of Wetlands* and *Bay B C's: a multidisciplinary approach to teaching about Chesapeake Bay*) have been distributed to over 60,000 educators in the U.S. and many other countries, and she has trained ± 3,000 educators. Britt is a native of Baltimore, MD, and holds a degree in biology from the University of Virginia.

Craig Tufts, Chief Naturalist, Manager,
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CRAIG TUFTS is Chief Naturalist for the National Wildlife Federation and oversees the Backyard Wildlfie Habitat Program which has over 18,000 participants, the new Schoolyard Habitats program, and is currently developing a community habitat- corporate outreach effort. He holds degrees from Cornell University in wildlife management and environmental education. Craig has authored two books on gardening for wildlife and frequently appears on TV and in print discussing this topic.

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Marilyn Wyzga, Project HOME Coordinator
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MARILYN WYZGA is an environmental educator, artist, and exhibit designer with a free-lance business, Feather's Edge Designs. As a consultant to New Hampshire Fish & Game since 1991, Marilyn has developed the schoolyard habitat program, Project HOME. She currently coordinates the statewide project, training teachers and workshop facilitators using the curriculum guide she authored, Homes for Wildlife. Marilyn has also taught graduate courses in environmental interpretation and exhibit design at Antioch/ New England. Her interpretive exhibits include three major installations at wildlife centers in NH. In her spare time, Marilyn practices backyard habitat enhancement and raps with resident fauna.

Guest Instructors

Cheryl Haberman, Earth Partnership
Univ. of Wisconsin-Madison Arboretum
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CHERYL HABERMAN, restoration outreach specialist, helps develop and teach teacher-training workshops, and guides and assists teachers and students in developing their school grounds. She presents at regional, and national conferences, develops activities, and coordinates Earth Partnership for Families Program at the Arboretum.

Kevin Holladay, Asst. Conservation Education Coordinator
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KEVIN HOLLADAY has been Assistant Coordinator for Conservation Education Section , New Mexico Dept of Game & Fish for the last two years. He is involved with Project WILD workshops, Natural History Weekends and the Schoolyard Wildlife Habitat program. Kevin has also worked 15 seasons for the National Park Service in resource management and interpretation throughout the West, Southwest and Alaska. He has also been involved with environmental education as an instructor with Yosemite Institute and Colorado Outdoor Ed. Center. He recently completed a Design Course in Permaculture at Santa Fe Community College that emphasized arid lands. An avid birder, Kevin is excited about the greening up (or ungreening, as the case may be) of our schools and the difference it can make for bird populations and the chance for students to get turned on to observing birds.

Molly Fifield Murray,
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MOLLY FIFIELD MURRAY is education manager at the University of Wisconsin-Madison Arboretum. She has lead Earth Partnership Institutes for teachers since 1991, conducted inservice programs for several hundred teachers throughout the state, spoken at state, national, and international education conferences, and is the author of *Prairie Restoration for Wisconsin Schools*.

Jeff Rucks, Project WILD Coordinator
Colorado Division of Wildlife
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JEFF RUCKS has a degree in Wildlife Management from Humboldt State University and is completing a master's degree in Education Administration. He has worked for the Colorado Division of Wildlife as a wildlife biologist and as a wildlife officer. He become Project WILD coordinator in 1993.

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KAREN VAN NORMAN has worked in environmental education since 1988. She has a masters degree in Biology with a botany emphasis. She was the Minnesota Project WILD Coordinator for nearly five years before taking a position in 1993 as Director of the School Nature Area Project (SNAP). Karen oversees a statewide grants program to aid schools in the development and use of nature areas. She supervises six staff who work with schools, providing environmental education training and nature area assistance.

Special Thanks to the U.S. Fish and Wildlife Service National Education and Training Center:

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☐ Native Plants

Native Verses Exotic Species

The plants you want in your natural area are natives, or those that grow naturally in your region. Ornamentals, or exotics, are plants that are imported from another place.

Plants and animals brought to this continent from other parts of the world do not have the same "checks and balances" that our native species do. Non-native species are called alien or exotic species. Some exotic species, like purple loosestrife and Eurasian water milfoil, are spreading across North America choking out native species. These invading aliens reproduce rapidly, spread easily, and have no natural enemies on this continent to control them. When an entire marsh - home to dozens of plant species that are used for food and shelter by dozens of animal species - is replaced by a dense growth of purple loosestrife, which native animals can't eat or hide in, what happens to species diversity?

Our common house cat is another exotic species. We brought it to this continent because we like the company and because "working cats" on farms help control mice and other small mammals that damage crops. But what happens when one of these cats goes off on its own? A study done in Wisconsin estimated that free-roaming cats in that state kill 137 *million* birds every year, especially birds that nest on the ground. What effect does this have on species diversity?

Adapted with permission from Wild River State Park, Center City, Minnesota. Written by Park Naturalist Dave Crawford, 1993.

Consider these four reasons for choosing native species over ornamentals.

1. Native plants are **adapted** to the soil, rainfall, and sunlight conditions of your region, so they are apt to thrive once established. Native plants have a home court advantage.
2. Native plants form the **food base** that native wildlife species adapted to your area depend on. Their presence in your natural area supports the species that live there.
3. Because natives have evolved adaptations to local conditions they require less **maintenance** and resources.
4. Non-native plants often lack the **natural controls** that help keep their populations in check. As they proliferate, they choke out the native plant species.

What's in a Name? The Problem With Cultivars

The next time you visit a plant nursery or a greenhouse look at the names of the plants. You will soon discover that plants often have more than one name. Many plants have both common names and scientific names.

For example, the native red maple's common name is "red maple" but its scientific name is *Acer rubrum. Acer* is Latin for maple and defines all of the plants in the world that have maple characteristics: similar fruit, flowers, roots, leaves, stem, etc.. *Rubrum* is its species name and describes a particular kind of maple with a defining characteristic that is distinct through generations — meaning a characteristic that a parent will always pass on to children and grandchildren and so on.

Sometimes a scientific name for a particular kind of tree will also have a cultivar name after its species name. For example there is a red maple tree that is known as *Acer rubrum* 'Northwoods.' This means that a particular tree was selected and propagated for its unique characteristics.

Cultivars are often made for special characteristics: fall color, flower structure, short stature, all kinds of reasons. But cultivars – because they are plants propagated from a single set of parents – do not have the opportunity to go through the natural process of random pollination. Therefore there is much less genetic diversity in a forest of cultivated 'Northwoods' red maples than would be found in a naturally occurring forest of red maples. Native plants – not cultivars – are important because without a wide variety of genetically different individuals, the ability of a species to survive changes in its environment is threatened.

from **Minnesota School Nature Areas: Notes on Benefiting the Biomes**, School Nature Area Project, 1996

94 / NATURE WATCH, ed. Wendy Hudson
Defenders of Wildlife

A WEALTH OF PARTNERS

Listed here are just a few of the types of partners you might consider when soliciting support for your site's development.

Federal Agencies
U.S. Fish and Wildlife Service
USDA Forest Service
Bureau of Land Management
National Park Service
U.S. Army Corps of Engineers
Bureau of Indian Affairs
Federal Highway Administration
Environmental Protection Agency
Soil Conservation Service
U.S. Department of the Navy
U.S. Department of the Air Force
U.S. Department of the Army
Bureau of Reclamation

State Agencies
Fish and Wildlife
Tourism
Parks and Recreation
Transportation
State Lands
Ecology, DNR
Land Use Planning
Forestry
Environmental Quality
Agriculture
Commerce
Water Resources
Education
Marine

Local Agencies
City/County
Parks/Planners
Schools
Visitor's Bureaus

Political
Governor
State Legislature
Congress
Local Officials

Education Institutions
Extension Service
Colleges/Universities
School Districts
Nature Centers

Private/Nonprofit
Conservation Organizations
Audubon Groups
National Wildlife Federation
Defenders of Wildlife
Sierra Club
Garden Clubs
The Wildlife Society
American Fisheries Society
Environmental Education Groups
Naturalist Organizations
League of Women Voters
American Association of Retired Persons
Private Landowners
Native American Tribes/Corporations

Industry
Tourism
Travel Agencies
Chambers of Commerce
Airlines
Car Rental
AAA
Charter Tour Groups
Guides
Hotels/motels
Restaurants
Real Estate
Oil Companies
Timber
Livestock
Photo, Binocular, and Recreational Equipment

Associations
International Association of Fish and Wildlife Agencies
Western Association of Fish and Wildlife Agencies
Northeastern Association of Fish and Wildlife Agencies
Midwestern Association of Fish and Wildlife Agencies
Southeastern Association of Fish and Wildlife Agencies

Bird Box Activity for Action Grant Workshop

This activity came about from a discussion with Judy Silverberg (NH Project WILD) at the NAAEE meeting in Portland, ME. We were wanting to include an activity in our habitat improvement workshops where participants actually did something to improve habitat for wildlife. Judy planned to have them build bird houses and I thought we could incorporate this with a communications activity we used at the YMCA Storer Camps outdoor education program.

At the workshop students are organized in teams. I would recommend between 3 to 6 students per team. The IN Action Grant Program asks for teams of 6 students and one teacher to attend. You need to have constructed a prototype of the bird house, feeder, or bat house you want them to construct. This needs to be placed in an adjoining room or behind a screen where the teams can not see it. You also need to set up a store where a team member can go to "purchase" the parts of the project. Set a "price" ahead of time for each pre-cut piece of wood, nails, and tool rental. I decided to use nails rather than screws because the screw holes would have to be pre-drilled and parts of that particular house kept together so the holes would match up. It also would make the construction of the house too easy because the holes would show where the pieces fit together. Finally you need "money" for each team. I put pieces of corn into film containers. I gave each team a couple of extra pieces of corn in case the team bought the wrong pieces. Our store would take returns but only at half price.

To start the activity each team had to choose some one to be their "expert" who would go in the other room and actually see the prototype. The experts could not go back to their team's table and see what the team was doing. They had to meet with a team messenger at the door of the room. The expert had to convey to the messenger what they had seen - design, type and number of parts needed. The messenger took that information back to the table where an accountant with a price list would see if they could afford the items on the list. The messenger then went to the store to purchase the items needed. The team then tries to construct their project from the description given by their expert. Messengers can go back to the door of the other room to ask further questions of the expert as construction goes on. The experts can not come to the team's table until the rest of the team thinks the project is complete. Some boxes were pulled apart and adjustments made. The whole process took about 45 minutes with 6th grade through high school students. I spent about $40 on materials for 15 houses.

Once the teams were finished we discussed that not only had they completed an action to improve wildlife habitat, they had begun to work as a team to complete a project. The "expert" had the vision of what had to be done and had to communicate that vision to the rest of the team, just as they who were attending this workshop had to communicate what they learned to others back at their school or community. They were working with limited resources and had to first see if they could complete the project as designed. They had to research what materials they needed, what materials were available and what the costs were.

Most importantly they had to communicate with one another and work as a team, using the skills and resources of everyone. By using the skills of everyone they were able to complete more than they could individually. We discussed the communications aspect. Were they saying one thing and their team members hearing another? What was the most difficult concept to convey? These were issues they would have to deal with no matter what type of action project they chose to try.

I heard very positive comments from the adults involved. One principal who had come with a group said "I just sat back and let them make mistakes. This is what I go through every day with teachers and students." Another teacher shared how two young ladies who had attended from her school started their presentation on the workshop to the rest of their class back at school with a description of how they had worked together to accomplish this project and how important communications were. Those ladies had pulled their box apart and worked through the lunch break and stayed late to get their box together just right.

I have attached a price list for our materials. This is an activity I will definitely use again. If you would like to try it and have any questions, please give me a call at (317) 290-3223.

Warren Gartner
Indiana Project WILD Coordinator
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Indianapolis, IN 46278

Price List

Nails (set of 4) - 1 ea.

Hammer Rental - 2 ea.

Measuring Device Rental - 1 ea.

Wood (All Sizes in Inches)

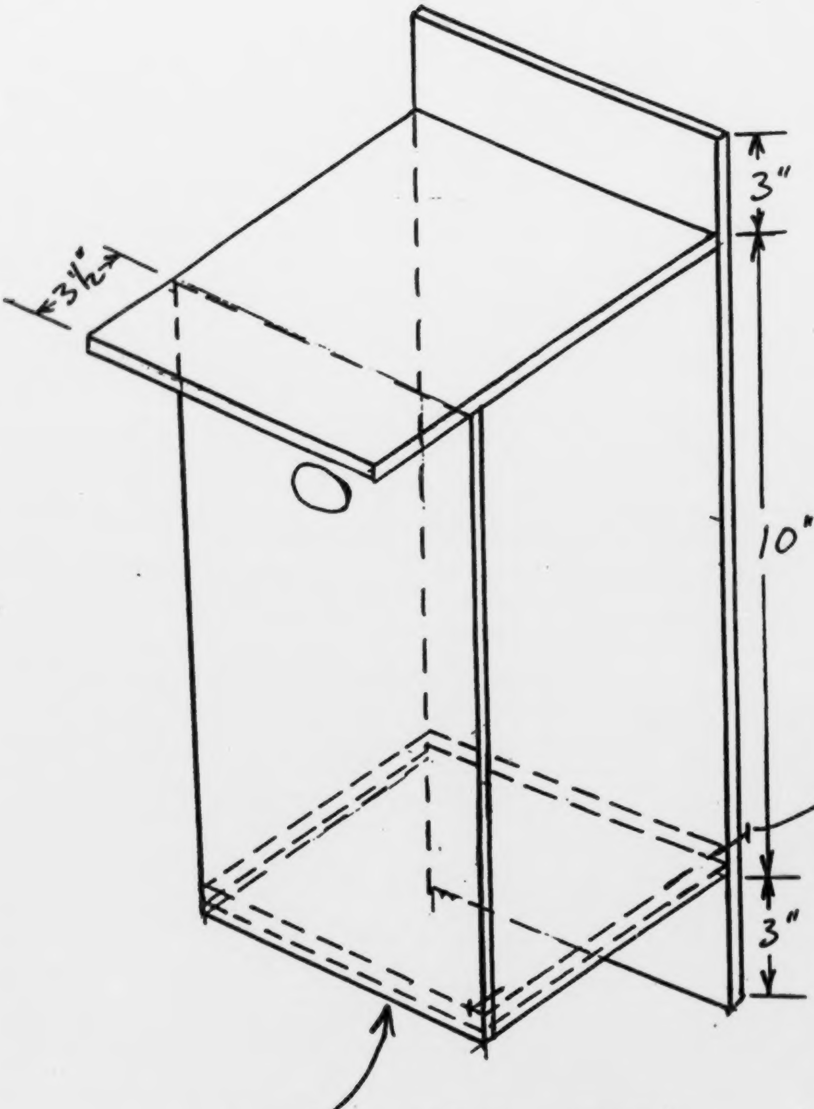
16X5.5 - 2 ea.

10X5.5 (with hole) - 2 ea.

10X5.5 (without hole) - 1 ea.

4X5.5 - 1 ea.

8X5.5 - 1 ea.


3½"
3"
10"
3"
bottom nails on one side are not nailed tight so side can be hinged out whe nails are removed so bird house can be cleaned
inset bottom ¼" from sides

Project HOME
Homes for Wildlife in the Schoolyard
Schoolsite Clues Activity

(adapted from the Ohio *Habitats for Learning* Program "Experience Activity, which was adapted from the Ohio *WILD School Site* Facilitator Workshop Activity "Every School is a WILD School Site")

Conducting the Activity:
(We use this as an ice breaker to begin each of our teacher training workshops for Project HOME. It gets the group thinking about the topic and their school site.)

- Distribute cards with the"clues" from the following pages, so that each participant receives one clue.

- Have participants form small groups by matching up with others having clues to the same school site feature.

- Small groups then complete the chart on the Clue Sheet, answering "How is that school site feature currently being used for various lessons or activities?" and "How could that school site feature be enhanced to provide for the habitat needs of wildlife?"

- Draw a map-view outline of a school building on a flipchart.

- Invite each small group to present to the large group their results, then add their enhancements onto the school grounds surrounding the building oultine, using markers to draw the features and enhancements.

"_________, _________, everywhere,
nor any a drop to drink."
(S.T. Coleridge, "The Eolian Harp")

"I think that I shall never see,
a poem as lovely as a _________."
(Joyce Kilmer)

"Jack and Jill went up a hill to fetch
a pail of ____________,
Jack fell down
and broke his crown,
and Jill came tumbling after."
(from a nursery rhyme)

"Under the spreading
chestnut _____,
the village smithy stands"
(Henry Wadsworth Longfellow, from "The Village Blacksmith")

"Mother, may I go out to swim?
Yes, my darling daughter;
hang your clothes
on a hickory limb,
and don't go near
the ______________."

"'Tis education forms the
common mind:
Just as the twig is bent,
the __________ inclin'd."
(Alexander Pope)

You can lead a horse to
____________,
but you can't make it drink.

"
__________,
swaying in the summer breeze,
showing off their silver leaves,
as we walked by."
(from a song by Chad and Jeremy)

"A small __________ holds
back a great wave."
(Homer, "The Iliad")

"Though nothing can bring back
the hour
of splendor in the __________,
of glory in the flower."
(Wordsworth)

"__________ of Ages,
cleft for me –
Let me hide myself in thee."

"As long as the moon shall rise,
As long as the rivers shall flow,
As long as the sun shall shine,
As long as the ______ shall grow."
*(North American Indian,
terms of a treaty)*

"Avoid the reeking bird,
Shun the polluted flock,
Live like that stoic bird,
The eagle on the _______."
*(E.H. Wylie, from
"The Eagle and the Mole")*

Leaves of _________
(poem by Walt Whitman)

How often do we find ourselves
between a __________
and a hard place?

KEEP OFF THE ___________!!

"Oh, say can you see,
by the dawn's early light,
What so proudly we hailed,
at the twilight's last gleaming.
Whose broad stripes and
bright stars..."

"A barrier, as of wooden or metal posts, rails, wire mesh, etc., used as a boundary or means of protection or confinement."
(Daniel Webster)

We raise it in the morning.
We salute it at parades.
We sing to it at sports events.
Every school site has one.

"Tom appeared on the sidewalk with a bucket of whitewash and a long-handled brush. He surveyed the ______ and all gladness left him and a deep melacholy settled down up his spirit. Thirty yards of board nine feet high."
(Mark Twain, The Adventures of Huckleberry Finn)

"'Shoot, if you must,
this old gray head,
But spare your country's ______,'
she said."
(J.G. Whittier, "Barbara Frietchie")

"My apple trees will never
get across
And eat the cones under his pines,
I tell him.
He only says, 'Good ________
make good neighbours.'"
(Robert Frost, from "Mending Wall")

Run it up the ________
and see who salutes!

"Give me land, lots of land,
'neath the starry skies above.
Don't ________ me in."

"An upright structure used for support of roof."
(Daniel Webster)

"A place, often part of a schoolyard, for outdoor games and recreation."
(Daniel Webster)

"All in all,
you're just another brick
in the ______________."
(Pink Floyd)

Word Scramble
A P Y L R D O N U G
_ _ _ _ _ _ _ _ _ _

Joshua fought the battle
of Jericho...
and the ___________
came tumblin' down.

Combine the following two clues:
1) A _________ on words
2) Hit the __________ running.

The Great of _______ China.
The Berlin _________.

The Riviera is the _____________
of Europe.

"A small pool of water, especially
on the ground."
(Daniel Webster)

Who can forget Kevin Costner's
baseball movie,
"A ____________ of Dreams"?

Although Carl's car was nothing
more than a ________ jumper,
he treasured the freedom
it brought.

"Strawberry ________ Forever"
(The Beatles)

"Just a little ___________ of
muddy water,
left there after the rain;
I got down on my knees to
look close –
I saw things I couldn't explain!"
*(Christine Lavin, from her song
"Amoeba Hop")*

Actress Sally _________ is known
for her portrayal of the television
character, the Flying Nun.

"Little Ducky Duddle,
went wading in a _________,
went wading in a __________
quite small – Quack! Quack!"

Famous movie about the rule of
the Khmer Rouge in Cambodia,
"The Killing ___________."

"They paved paradise,
put up a ______________."
(Joni Mitchell, from the song, "Yellow Taxi")

"A path for pedestrians, usually paved, along the side of a street."
(Daniel Webster)

Today's snowfall has turned the freeway into a ________.

"East side, west side,
all around the town,
The gang sang 'Ring-a-Rosie,'
'London Bridge is falling down;'
Boys and girls together,
me and Mamie O'Rorke,
Tripped the light fantastic
on the _________of New York."
(Charles Lawlor & James Blake, 1894)

Word Scramble:
KRGPAIN OTL
_ _ _ _ _ _ _ _   _ _ _

While in Paris, enjoy a romantic dinner at a ______________ cafe.

An area to store your car while you go shopping.

"City ________, busy ________,
dressed in holiday style."
(from the Christmas carol, "Silver Bells")

Project H.O.M.E.

Homes for Wildlife in the Schoolyard

Schoolsite Clues Activity

(adapted from the *Habitats for Learning* Program "Experience" Activity)

Favorite Clue: ______________________________

Site Feature: ______________________________

Present Uses	Possible Habitat Enhancements

Remember to consider:

- wildlife habitat needs (food, water, cover, space) and how they are arranged
- a variety of subject areas (science, math, social studies, language arts, fine arts, physical education, industrial arts, etc.)
- an interdisciplinary approach
- short term and long term activities
- seasonal changes
- assessment and evaluation
- real-life connections
- student-centered, student-driven projects

3: Investigating the Schoolyard Landscape

School Wildlife Habitat Project Guide

U.S. Fish and Wildlife Service
177 Admiral Cochrane Dr.
Annapolis, MD 21401
410-573-4584

Draft
July 1996

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    A. General information
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IV. Meadow Project: planting a wildflower/grass meadow
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About this guide

This purpose of this booklet is to provide students basic step by step guidelines for restoring or creating natural habitats including forests, wetlands, and meadows on school grounds. Students will be able to identify areas of low habitat diversity, then through research and investigation, design a planting to establish a forest, wetland or meadow habitat. The projects can range in size from a small 20' by 20' area to an acre or more.The steps were developed from the experiences of several schools that have completed projects. The guide challenges students in critical thinking and decision making. The project incorporates reading, science, mathematics, and language arts skills. Since these are natural habitat projects, we strongly advocate using only native or indigenous plants for these projects. Creating natural areas on school yards has several benefits:

- Provides an opportunity for students to learn and use knowledge and skills in a practical application
- Creates natural areas for hands on instruction and exploration
- Improves the aesthetics of barren school landscapes
- Reduces school mowing costs
- Provides habitat for local and migratory wildlife
- Provides vegetative buffers to nearby streams
- Creates natural areas for community use
- Establishes a model of land stewardship for the local community

How to use this guide

The guide is mostly self explanatory. The first section covers logistics and general information about starting a project and picking a project site. The first section also includes steps on how to sample environmental factors including soil sunlight and moisture so that appropriate plants can be selected. Sections 2-4 provide details on how to complete a wetland, meadow or forest planting project. In each of the project sections, there are steps that require students to complete certain tasks. Each one of the steps has a specific set of directions to follow. We expect that you will need to modify certain steps within the guide to meet the educational needs of students and the specifics of your project. There are several other guides available that go into more detail on other aspects of habitat related projects. Many of these guides are listed in the appendix resource section. This guide focuses on the basic steps needed to restore or create habitat for wildlife.

I. Getting Started

A. General Information: There are many different ways to organize a habitat restoration project. The following are a few general suggestions on getting started.

1. Form a team: Organize a dedicated group of students, teachers, and parents that will be responsible for completing the project. As the project evolves, the team can be broken into groups to accomplish different tasks such as fund raising, community outreach, organizing a planting, finding equipment, etc.

2. Inform: The school principal, parents, supervisor of maintenance and the adjacent community must be aware of the project.

3. Assistance: For additional help consider contacting some of the following groups. Be careful not to let the experts or volunteers do the project for you. Remember students should be using critical thinking skills and making decisions throughout the project.
-natural resource experts (see appendix for a general list)
-nurseries (especially those that specialize in native plants)
-PTA's
-local environmental groups
-college students
-local businesses
-grant giving organizations
-senior citizens
-scout groups
-civic groups

4. Documentation: Create a journal where students can keep track of all the information about the project. Include pictures, drawings, receipts, grants, newspaper articles, etc. This is a very important and useful step that unfortunately many schools leave out.

5. Signs: It is very helpful to put up signs advertising the project as a wildlife habitat restoration. This will let people know that you haven't forgotten to mow the lawn, and that you are doing something very beneficial for local wildlife.

6. Communication: It is a good idea to have the students communicate with the local community through developing a flyer, doing a presentation or inviting them to participate. The projects being advocated in this booklet are natural area restoration projects. These projects will at some or all times during their development be perceived by some people as being weedy or overgrown. Therefore, good communication with neighbors is crucial.

7. Maintenance: The success of any project involves a well thought out maintenance plan. There are two essential factors to consider. The first is to communicate with the person that supervises the school mowing. Design your project to create less work for mowing crews. For instance, if you plant a meadow it will need mowing at least once

every other year. Make sure your mowing crew is aware of this and make sure they have the equipment to mow a tall grass meadow. The second factor is summer watering. To achieve a good survival rate for tree and shrub plantings it is essential to water new plants throughout at least the first summer. Details about maintenance are given in each section.

B. Selecting A Habitat Restoration Site

Directions: In this step you will identify an area that you can change into a natural habitat for wildlife. The first step is to become more familiar with different natural and man made habitats. Read the following Habitat Fact Sheet, and Habitat Profiles then answer the questions. If you already know the type of project you want to do and have a site picked out, skip to the next step.

Habitat Fact Sheet

All species have certain basic requirements for life -- food, water, shelter, and space. These make up a plant or animal's ***habitat.***. Natural habitats provide safe places for feeding, hiding, resting, and raising young. In most habitats, plants provide many of the basic needs for animals. Plants provide food from nuts, seeds, berries, fruit and nectar. Plants also provide shelter and places to make nests and raise young. Plants provide habitat for lots of different insects. Insects are a major food source for birds, amphibians, reptiles, mammals and other animals.

Your schoolyard is already a habitat for some living things. The parking lot could even be considered habitat for the ants that live in the small cracks in the pavement. The school lawn is a man made habitat for a few kinds of insects and birds. Habitats can be low in diversity or variety of plants and animals (like a lawn) or can be high in diversity like a natural habitat (forest, grassland meadow or wetland). Biological diversity or biodiversity, is a term that is used to describe the variety of plants and animals in an area. A lawn is an example of a habitat low in biodiversity. A forest is an example of a habitat higher in biodiversity.

Changing habitats

Sometimes a habitat changes by natural events, such as a fire caused by lightning, a flood, or a plant disease. When a forest is burned by fire or cleared for timber harvest, sunlight reaches the forest floor and a meadow of grasses and wildflowers soon appear. As time goes on, small shrubs and tree seedlings sprout to create a scrub/shrub area. Over time, trees grow and the forest habitat returns. The process of habits changing over time from one type to another is called *succession*. People also change habitats, unfortunately the change can be permanent. When a forest is cleared for a new housing development, shopping center or highway, most of the plants and animals will not return since their habitat has been drastically changed. The main reason for plants and animals becoming endangered or extinct is the loss of habitat.

People helping habitats

Many homeowners, farmers, business owners and students realize that habitat is important. These people are learning to restore small areas of habitat on their farms,in their backyards and on their school yards. **The basic concept of habitat restoration is to identify areas that are low in habitat diversity and change these areas to make them higher in diversity**. These actions are extremely important in order to maintain healthy populations of plants and animals.

Habitat Profiles

Man-made habitats

Lawn: A mowed area a few inches tall dominated by turf grasses that form a dense mat.
Plants: primarily non-native grasses, clover, and weeds.
Wildlife food: some seeds and nectar produced by clover and weeds like dandelions.
Shelter: very few hiding or nesting places for most wildlife, the exception being some insects.
Wildlife: minimal use by rabbits. Bird use includes, starlings, robins and a few others, use by certain insects.
Habitat diversity: very low.
Maintenance cost: high

Formal landscape: The planted landscapes around houses and buildings.
Plants: mainly non-native shrubs and flowers, planted mostly for aesthetic value.
Wildlife food: some berries and nectar.
Shelter: dense evergreen shrubs and hedges provide shelter for some species.
Wildlife: mammals include rabbits and a few others. Birds include robins, house wren, house sparrow, mockingbird and a few others. Minimal use by amphibians and reptiles. Some use by insects.
Habitat diversity: low. Many homeowners are improving the diversity by using native plants and modeling their landscapes after natural plant communities.
Maintenance cost: medium to high.

Park environment: An area that has scattered trees with lawn as the ground cover.
Plants: Native or non-native trees, lawn grass
Food: nuts and seeds
Shelter: trees provide shelter for some species
Wildlife: habitat for insects, certain birds and small mammals including squirrels, and chipmunks.
Habitat diversity: low to medium
Maintenance cost: medium

Natural Habitats

Meadow: An area with tall grasses and wildflowers. In the Central United States this type of grassland is called a prairie.
Plants: good diversity of primarily bunch forming grasses and wildflowers.
Wildlife food: abundant nectar, seeds and berries.
Shelter: many hiding places in between clumps of tall grasses. Good protection for burrowing animals.
Wildlife: small mammals including rabbits, groundhogs, voles, foxes. Birds including sparrows, quail, goldfinches, bluebirds, hawks, and many others. Many insects including an array of butterflies. Some reptiles and amphibians in wet meadows.
Habitat diversity: high.
Maintenance cost: low

Scrub/shrub: An intermediate stage between a meadow and forest. Usually has a dense scrubby look.
Plants: A very diverse plant community of tall grasses, wildflowers, shrubs and tree seedlings.
Food: nectar, seeds and lots of berries.
Shelter: many nooks and crannies for hiding and nesting. Thorny brambles provide dense cover for many species.
Wildlife: Many of the same species as the meadow. In addition, other birds including catbirds, towhees, cardinals, flycatchers, and warblers.
Habitat diversity: high
Maintenance cost: very low

Forest: A woodland or area dominated by large trees. Scientist divide forests into different types depending on the dominant tree species. Before the colonists arrived most of the eastern United States was forested. Since forests were the dominant natural habitat, many wildlife species are adapted to living in forests.
Plants: Native plants including large trees, small trees, shrubs, ferns, mosses and wildflowers.
Food: nectar, leaves, buds, seeds, nuts, berries
Shelter: lots of hiding places among the leaves, rotting logs, standing dead trees or snags, brush, and leaf litter on the forest floor.
Wildlife: Mammals including deer, raccoon, squirrel, chipmunk, opossum, mice. Many species of birds including red tailed hawk, sharp-shinned hawk, scarlet tanager, wood thrush, American redstart, parula warbler and many others. Amphibians including spotted salamander, wood frog, spring peeper and others. Reptiles including box turtle, black rat snake and more. Many insects including butterflies.
Habitat diversity: high

Maintenance cost: very low

Wetland: There are many different types of wetlands. A marsh is wetland dominated by herbaceous plants, like cattails, that grow in standing water. A swamp is wetland with standing water and is dominated by trees. A scrub/shrub wetland is primarily shrubs. A palustrine forested wetland is dominated by trees although standing water is only present during wet seasons.

Plants: Native grasses, sedges, rushes, wildflowers, shrubs, trees, and others

Shelter. Plants provide a variety of excellent nesting and hiding places.

Wildlife: Since nearly all wildlife needs water, many species that live in other habitats will also use wetlands. Mammals including muskrat, beaver, deer, voles. Nearly all species of amphibians need at least a temporary pool of water to breed. Insects including dragonflies, butterflies, and many more. Birds including all ducks, all herons, all rails, many shorebirds, prothonotary warbler, phoebe, kingfisher, red shouldered hawk, and many more.

Habitat diversity: high

Maintenance cost: low

Note: with all the habitat types there are several other factors that can either enhance or limit the use by wildlife. The size of the habitat will influence the type of wildlife you may see-generally larger habitats support more wildlife. The land adjacent to the habitat also influences the diversity of wildlife that will use the habitat. Environmental factors including soil type, temperature, and rainfall will influence the type of plants found within each habitat.

Next, go outside and walk around the school grounds and complete the following questions.

1. Are there natural habitats on or near your school grounds? Sit in or near a natural habitat for 5 minutes and observe. Use all of your senses to describe what you observe.

2. Are there man-made habitats on your school grounds? Sit in or near a man made habitat for 5 minutes and observe. Use all of your senses to describe what you observe.

3. Identify 2 areas of man-made habitats that your class could change into a natural habitat (forest, scrub shrub, wildflower meadow or wetland)

Estimate the size of these 2 areas. Area 1 estimate____ Area 2 estimate______
Measure the size of these 2 areas. Area 1 measurement____ Area 2 measurement___

4. What type of natural habitat would you like to change this area into? List 3 reasons.

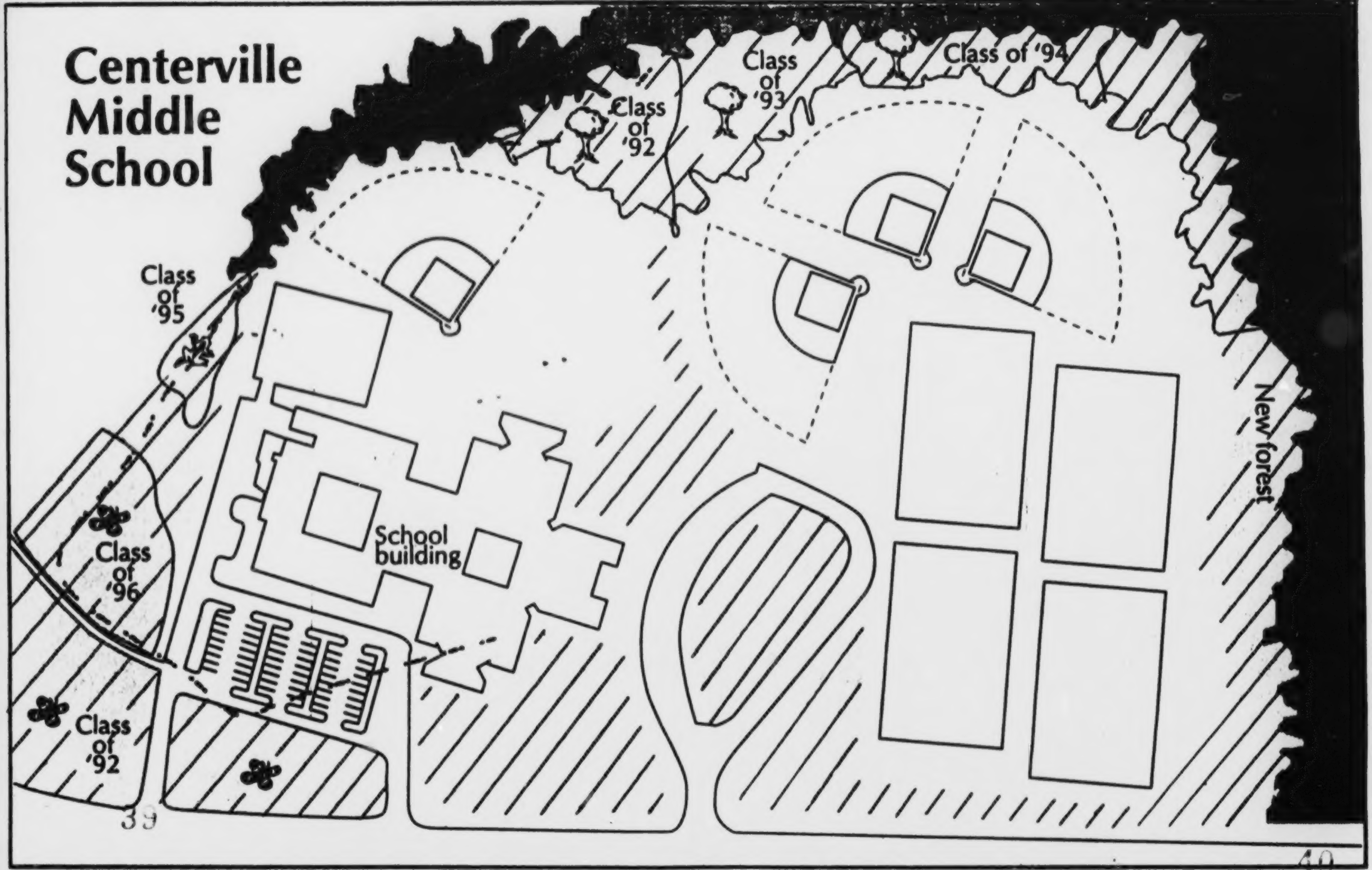
5. Predict the types of wildlife you may see if you can change this area into a natural habitat. Use evidence you have observed or information from the fact sheet to support your prediction.

A school wide plan. (Optional step)

Background. Create a habitat restoration plan for your entire school grounds or school ecosystem. Wildlife managers call this an ecosystem management plan. It is very easy to do. A long range plan will give many students an chance to take place in habitat activities over several years. Grant giving organizations prefer projects with long term ongoing activities.

Directions. Obtain a copy of your school blueprints or make your own map of the major features of your schoolyard. On your map show the school building, roads, parking lots, playgrounds, and athletic fields. Also add natural features including streams, woodlands, wetlands or meadows. Add anything else you want to the map. Next, walk around the school grounds and identify all the areas where your group and future students can create natural habitats. These would be all the areas of man made habitat that are not used for any activities. The example from Centreville middle school on page xx should give you some ideas of how to do this. In this example, students completed a survey of the entire school grounds. They identified all areas of low habitat diversity (mostly lawns) where they could complete habitat projects. Notice that students from previous years have already completed several projects.

Centerville Middle School



Students at Centerville Middle School have been working since 1992 to restore native plants and animals to parts of the school yard. The first step was to identify all the areas where habitat could be made better. All of these areas were grass or bare ground. As of 1996, students have changed 1.8 acres of land into new forests, meadows and a shallow wetland area. There are meny new types of birds, frogs and butterflies that students now see reguularly that were never seen before their efforts began. By eliminating 1.8 acres of mowing, the school saves $800 per year in maintenance costs. When the project is complete, sometime beyond the year 2000, students will have changed about 5 acres of unused lawn into natural habitat.

■ Existing forest
// Potential restoration area
⁄⁄ Intermittent stream
🌳 Reforestation
✿ Meadow
✿ Wetland

C. Sampling the site's environmental factors

Directions: Once you have picked a site for a project, the next step is to gather information on 3 environmental factors including sunlight, the type of soil and the amount of moisture. This step will help you: verify that your site is appropriate for the type of habitat project you want to do; select the type of project if you haven't yet; and select the type of plants that will grow the best in the conditions you have. Some sites will be suitable for any type of project while other sites may be better suited for one type of project. You may be able to do several habitat types in one area. The information you gather in this step will also help when choosing plants or seeds. Each one of the 3 environmental factors can influence or affect the other. For example: a site that is flooded or wet may be that way due to a lot of clay in the soil which prevents water from soaking into the ground.

There are three steps in this section. Follow the specific directions for each step

Environmental factors needed for each habitat type

	Sunlight	**Moisture**	**Soil**	**Existing Plants**
Meadow	Full sun preferred	Wet to dry	Most types	Lawn, bare ground, scattered small trees
Wetland	Full sun to shade	Wet, flooded	Silt clay or clay preferred	Lawn, bare ground, other
Forest or Scrub/Shrub	Partial to full sun	Wet to dry	Most types	Lawn, bare ground, scattered trees

1. Sunlight

Directions: Read the following descriptions of sunlight and predict which of the 3 choices you have on your site (You could have more then one)__________

Full sun means the site is in direct sunlight for at least 6 hours a day during the growing season.
Partial sun means the site receives 3-6 hours of direct sunlight.
Shade means the site receives less then 3 hours of direct sun.

2.Develop and describe a method you could use to scientifically measure the amount of sunlight in order to test your prediction.

3. If necessary, use the method developed in step 2 to measure sunlight.

4. Which of the 3 light conditions do you have?_______________

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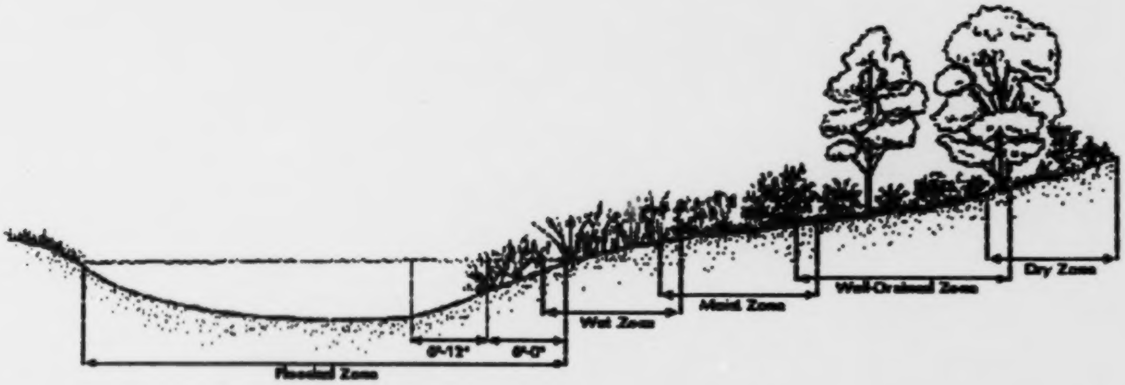
2.Moisture (Drainage)

Directions: In this step you will determine how moist your site is. There are several factors that can influence moisture including the type of soil, amount of sunlight and the position of the site in the landscape (low lying area, on a hill, near a spring etc.) Look at diagram __ to help understand the range of moisture possible. In this step you will estimate the range of the moisture within your site. A range covers more then one value.

Ranges
Flooded to wet
Wet to moist
Moist to well drained
Well drained to dry

1. Read the following descriptions of moisture and predict the range of moisture you expect to find on your site.________________________



Flooded: Areas where standing water is present for much of the growing season. This is where typical emergent wetland plants like cattails grow.

Wet: Areas where the soil is saturated for much of the growing season. Wet conditions can be found on the edge of ponds, streams and rivers and in ditches. Wet conditions may exist in poorly drained soils that contain a high clay content. Many plants that prefer wet conditions can tolerate periodic flooding as well as periodic drought.

Moist: Areas where the soil is damp. Moist areas can be found near waterways or in depressions. Moist conditions can be found where the sun and wind are partially blocked such as in a woodland, or on the shady side of a building.

Well drained: Areas where rain water drains fairly quickly. Puddles do not remain for more then a day or two after hard rains. Generally, well drained areas consist of soils that contain enough sand particles to allow rainwater to percolate down through the soil.
Dry: Areas in full sun or in a windy location. South facing slopes or areas against a south facing wall may have dry conditions. Sandy soils drain well and have a tendency to be

dry. Steep hills may be dry if rain water runs off quickly. Water does not remain after a rain in dry areas.

2. Dig a hole about 8" deep. Take some soil from the bottom of the hole. Place approximately 2 tablespoons of soil in your hand. Rub the soil between your fingers. Is it wet, dry, moist? Use this additional information to decide which of the moisture ranges you have on your site. (You could have more than one range for different parts of your site.)

3. Soil

Directions: In this step you will gather some basic information about soil. Your group will decide on the soil texture and decide if your soil is compacted. Soil texture refers to the particles that make up the soil. Soil is made of three size particles: sand, silt and clay, with sand being the largest particle and clay the smallest. Silt is an intermediate size particle. See diagram __ for size comparisons. Soils have different textures depending on the amount of the sand, silt and clay in the soil. Soils with a high percentage of sand will feel gritty. Soils with a high percentage of clay will feel sticky. Soils dominated by silt will be somewhere in between. *Soil compaction* refers to how tightly the soil is packed together. Small spaces between individual soil particles (pore spaces) allow air and water to move through the soil. Plant roots absorb air and water for growth. When soils become compacted the pore spaces get squeezed restricting the movement of air and water. Under these conditions plants will not grow well. Compacted soils also make root growth difficult. Soils become compacted from heavy equipment, lots of people walking on one path or other reasons.

1. Dig a hole 8" deep. Take a sample of soil from below the topsoil layer. Topsoil is a thin layer of dark soil at the surface. Follow the instructions on the soil texture chart on page xx and determine the soil texture

Soil Texture______________________

2. Fill the hole with water.
Time how long the water takes to drain. Time______

b. Are there other plants growing on the site? Are they healthy and lush or weak and scraggly?_________________________
c. Is there bare soil present?____________________
d. Was it very difficult to get a shovel in the ground?_______________________

3. Based on the information you collected, is your soil compacted? Use observations you made to explain your answer.

Summary of site conditions

Light__________________________
Moisture________________________
Soil texture______________________
Soil compaction?__________________

Note: If you found the soil to be compacted, then we recommend asking your local forester, nurseryman or other expert for advice.

You are now reading to begin planning a habitat planting project. Refer to the specific section for more information.

D. Additional Habitat Components

The main focus of your habitat restoration project should be creating more diverse habitat by planting native plants. In addition, there are other wildlife management techniques that can be incorporated into habitat projects. There are several things that you can incorporate into a habitat to make it easier for people to view wildlife and access the site. A list of suggestions is given in the appendix. Refer to the library or the internet for the details of how to build or incorporate these additional components.

4A: Wetlands

Wetland Habitat Projects

This section covers surveying the school grounds to look for a possible area to construct or restore a wetland. Also covered are the steps needed to plan and design a wetland planting. The planting could be a newly created wetland or planting a marshy fringe around an existing pond. The technical aspects of wetland design are not covered although some general tips are included. Since each situation is unique, we recommend seeking advice from a wetland expert to help with the wetland design, grading plan etc.

Outline

I. Background Information
    A. What Are Wetlands, Why Should We Care?
    B. What are Stormwater Management Ponds? (Optional reading)
    C. Types of wetland projects
II. Site Surveys
    A. Wetland site survey (look for a possible wetland site)
    B. Wildlife habitat survey of a pond
III. Design and Construction Tips
IV. Planting Plan
    A. Order nursery catalogs
    B. Determine size of planting area
    C. Calculate the number of plants to order
    D. Site environmental factors
        1. light
        2. moisture
        3. soil
    E. Select plants
    F. Planting diagram
    G. Plan review
    H. Order plants
V. Planting Day
VI. Maintenance

I. Background Information

Directions: The first step in your wetland project is to learn a little bit more about wetlands and the different types of wetland habitat projects. Read "What are Wetlands, Why Should We Care" and "Types of Wetland Habitat Projects". If you are working with a stormwater pond, read "What are Stormwater Management Ponds." There is lots of additional information about wetlands in your library or on the internet (key search words: wetlands, marshes, swamps, prairie potholes, vernal pools). After you learn more about wetlands, answer the questions after the reading.

What Are Wetlands, Why Should We Care?

Wetlands are basically wet-lands. Some examples of wetlands include swamps, bogs, and marshes. They have three things in common: water, water-logged soil, and plants adapted to a wet environment. Most wetlands are covered with shallow water at least part of the year. Some wetlands rarely have standing water. Wetlands are very important. They are a home to many different species of wildlife. Wetlands and the plants living in the wetland provide food, water, shelter, and hiding places to the animals of the area. They prevent floods by slowing down rainwater running off the land. They also filter toxic pollutants, excess nutrients, and sediment (soil from the runoff water).

Unfortunately, only recently have people begun to understand the importance of wetlands. In the past 50 years, the Chesapeake Bay watershed has lost many acres of valuable wetlands. At least 50% of the land that was once wetlands has disappeared. Most of the wetlands have been lost due to the development of the land for homes, roads, farms, stores, and other buildings. Creating wetlands and planting wetland plants can help replace some of the wetlands that have disappeared.

What Are Storm Water Management Ponds?

The human population keeps growing and growing. As the population grows, land that had been meadows, forests and wetlands are being developed into houses, schools, roads, shopping centers, and other buildings. This creates a problem. When it rains on land that has vegetation (plants) growing on it, the vegetation helps slow down and absorb the rainwater. The water can soak into the soil. This is a good thing since the soil filters and cleans the water before it slowly seeps into a nearby stream. When rainwater falls on land covered with concrete or buildings, the rain cannot soak into the ground. Instead, the water runs across the paved surface and usually into a stormdrain (the grates that you see next to the curb). Since there is nothing to slow the water down, it rushes down the stormdrain into a nearby stream. Once in the stream, the rushing water carves away soil from the stream bank and makes the water muddy. Muddy water causes harm to aquatic life. As rainwater flows across roads and parking lots, it can pick up many harmful pollutants. The combination of muddy water and pollutants from streets and parking lots harms fish and other life in the stream.

Structures called Stormwater Management Ponds are often built to help reduce the problems caused by stormwater. These ponds catch the water before it enters a stream. The water is then slowly released into a stream. Slower moving water will not erode the banks of streams like fast moving water. Also some stormwater management ponds hold the water for many days or even all year. In

these types of ponds, wetland plants, bacteria and other natural processes help break down pollutants into less harmful substances. Wetland plants also cause sediment to settle out of the water column. While most stormwater management ponds reduce the effects of erosion and pollution, they are not usually designed to provide a natural habitat that is beneficial to wildlife.
Julie Tracy, Hollywood Elementary

Types of Wetland Habitat Projects

The following is a list of terms that describe different types of wetland projects.

Wetland restoration means reestablishing a wetland in an area that was once a wetland but was somehow changed. People have changed wetlands by filling them with dirt, digging ditches through wetlands causing water to drain away or changing the source of water for the wetland. Wetland restoration can sometimes by a simple process of removing fill dirt, damming a drainage ditch, plugging underground drainage pipes or restoring the source of water to a wetland.

Wetland creation means changing an area that never was a wetland into a wetland. The best place to create a wetland is in a spot that receives natural runoff of rain or spring water. Stormwater running off fields, parking lots or roofs can also be used. In many cases it is simple to dig out a shallow basin or build a small dam to catch and hold runoff water. Wetland creation can be done in certain types of stormwater management facilities. Sites with clay soils are good for wetland creation.

Wetland enhancement can refer to several types of projects: One popular enhancement project is planting a variety of native wetland plants in and around existing ponds, lakes, rivers or streams. These projects can include planting in stormwater management ponds. A second type of enhancement project involves removing invasive plants from a wetland. Invasive plants grow aggressively and smother native vegetation causing changes in the habitat.

In all types of wetland projects, the wetland plants serve many purposes. Plants can help trap sediment, hold soil to reduce erosion, trap and biologically treat pollution and provide excellent habitat for wildlife.

1. Use the reading and other resources and provide 3 reasons as to why you want to build or plant a wetland on your schoolyard.

2. Based on the description in the reading, which type of wetland project will you be doing?

3. Write 2 questions you want to know about wetlands that were not covered in the reading.

4. List at least 5 species of wildlife you hope to provide habitat for with your wetland project.

II. Site Surveys

There are two surveys in this section. Complete the *Wetland Site Survey* if you want to find out if there is a good place on your schoolyard to create or restore a wetland. Complete the *Wildlife Habitat Survey* if your interested in enhancing the habitat of an existing pond.

Wetland Site Survey

Directions: There are two main things to look for when trying to find a place to build a wetland. The first is water and the second is soil that does not drain well. The best spot to build a wetland is in a low lying area that is flat. Its nearly impossible to build a wetland on the side of a hill. If you can find or create these conditions then you can plant a variety of wetland plants to create a wetland. To complete this survey walk around the school grounds and look very carefully for clues to help decide if there is a good spot to create or restore a wetland.

1. After completing the steps call or write a letter to a wetland specialist asking for additional assistance. The wetland specialist should be able to verify your survey results and work with you on designing the project. Sources of assistance for wetlands can be found in the appendix on page __.

A. Water. The presence of water or a method to get natural runoff water to an area is the most critical factor in determining if your site can support a wetland. Think about where all the rain water goes after a hard rain. Does it soak into the ground? Does it run down a ditch or stormdrain? Look for one or more of the following sources of water.

Possible sources of water:
Ditches or swales made to carry water
Pipes designed to carry water
A spring or water seeping out of the ground
Water from the school roof
Water from the parking lot

Note: While streams are a good source of water, in most cases diverting water from a natural stream system is not recommended as it can do more harm then good.

1. Walk around the schoolyard and look for possible sources of water. If you are having trouble, wait for a hard rain, put on rain coats, then go outside and look again. Locate and describe one or more areas that have a source of water. For each area, describe where the water comes from and where it goes.

2. If you found a source of water, imagine intercepting some of the water by digging a shallow pool 1' deep or by building a small dam to trap some of the water. Consider the following: Is there enough room to dig a shallow pool or build a small dam? Is the land flat enough? Would you have to cut down trees? Based on your observations, would it be possible to catch some of the water and create an area where water would sit for several weeks or months. Support your answer with evidence observed at the site.

Stop. If you did not find a source or water then consider another type of habitat project. It is possible to build an artificial pond just about anywhere, Artificial ponds should not be confused with wetlands as they are very different.

Soil. The next step is to look closely at the soil in the possible wetland site. By completing this step you can learn if there is enough clay and silt in the soil to hold water for a long enough time to create a wetland. You also may be able to tell if your site was once a wetland even if it does not look like a wetland. Wetland soils usually contain clay. Clay particles are very tiny and tightly packed together. That is why water cannot easily soak into the ground through clay soil.

1. Soil Texture. Dig a hole at least 15" deep. Take a small handful of soil from the bottom of the hole. Follow the directions on the Key to Soil Texture Chart on page__. Soil textures including sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay and clay can be good for building a wetland. Based on your findings, what type of soil texture do you have?

2. Drainage. Slow draining soils are good spots to establish a wetland. Using the same hole, fill the hole with water and time how long it takes for the water to completely drain. If the water takes more then 48 hours to drain then you may have enough clay in the soil to create a wetland. How long did the water take to drain?

3. Color. Soils that are saturated with water for long periods of time have distinct color characteristics. Wetland soils are sometimes gleyed which means they are a gray, greenish or sometimes bluish gray in color. Mottled soils are another characteristic of wetland soils. Mottled means the soil has lighter gray areas speckled with orange, red or brownish spots. Caution. You may have to dig deeper than 15" to find gleyed and mottled color characteristics. Within the hole you dug can you locate

gleyed or mottled color characteristics?

4. Smell. Some types of wetland soils have a sulfur or rotten egg smell. Describe the smell of the soil.

5. Summary. Based on your study of the soil, do you have the right type of soil to build a wetland? Use evidence from your field study to explain why or why not.

Stop. If you found a source of water but did not find the right kind of soil to build a wetland do not be discouraged. Wetlands can be built by digging a shallow depression and lining the bottom with clay. Clay can be brought in with dump trucks. Some sand and gravel quarries sell clay.

Now that you have completed the survey you will need to invite a wetland specialist to the school to check and verify the survey results.

Wildlife Habitat Survey of a Pond

Directions: This survey is for measuring the habitat value of a pond (could be a stormwater management pond), and making recommendations for improving the habitat. Complete the survey, answering the questions as best you can.

General Observations

1. Where does the water come from that flows into the pond?

2. Where does the water go that flows out of the pond (stream or other body of water)?

	Points Possible	Points Scored
Water		
1a. There is water in the pond all year.	10	____
1b. There is water in the pond only part of the year.	7	____
1c. Water remains in the pond for only a few days.	0	____
Shelter/Space		
Plants growing in the pond		
2a. Native wetland plants are present along at least 75% of the edge.	10	____
2b. Native wetland plants are present along 50- 75% of the edge.	7	____
2c. There are only small patches of wetland plants present.	3	____
2d. There are no wetland plants present.	0	____
3. Subtract 10 points for each type of invasive plant present (phragmites, purple loosestrife)		
Plants growing within 30 feet of the pond		
4a. Natural vegetation (trees, shrubs, tall grass and wildflowers) cover over 50% of this area.	10	____
4b. Natural vegetation covers between 25% and 50% of this area.	7	____
4c. There are small patches of natural vegetation in this area.	3	____
4d. There is no natural vegetation- the entire area is mowed lawn.	0	____

5. Partially submerged logs, or rocks are present.	5	____
6. No submerged rocks or logs are present.	0	____

Plant Food (plant food including seeds, nuts, berries, nectar)

7a. There are at least 10 different types of wildlife food plants.	10	____
7b. There are at least 5 different types of wildlife food plant.	7	____
7c. There are 3-5 different types of plants that provide wildlife food.	5	____
7d. There are no obvious plants that provide wildlife food.	0	____

Wildlife

8a. Score 1 point (up to 15) for each type of insect found	15	____
8b. Score 2 points for each different type of bird seen or heard	15	____
8c. Score 2 points (up to 14) for each sighting or sign of other wildlife (burrows, tracks, scat, feathers).	14	____

Adjacent Habitat

9. The pond is located next to a natural area such as a woodland or meadow (score 10). The pond is isolated with large amounts of mowed grass between the pond and the closest natural area (score 0). Use your judgement to score this category between 0 and 10	10	____

Summary of Survey

1. How many points would a pond with excellent habitat score?

2. How many points did your pond score?

3. What evidence did you find that shows wildlife (including insects) use your pond?

4. What could you do to improve the score or your pond?

III. Design and Construction Tips

This section is provided as information to share with people that will be in charge of designing the wetland and supervising the construction.

Design

Size

The main issue to think about when determining the size of the wetland is future use by students. Students may be wading in and around the wetland collecting plants, organisms etc. The wetland should be a certain size so that students are not standing on top of each other. Also, the impact to the aquatic system from lots of use will be minimal if it is spread over a larger area. A good size is 1,500 sq ft. or larger. In reality, you may be restricted by the area available and the amount of water available. Creating several smaller wetland pockets with upland in between is another good option.

Shape

An irregular shape is best as it creates a more natural look. An irregular shape will make more nooks and crannies which can provide better habitat and make it more interesting for exploration. The bottom contour should also be irregular. Hummocks or small islands that project out of the water are an excellent feature to include. Different species of plants will spread and colonize certain areas of the wetland based on small differences in water depth. A hummocky or rough bottom contour will allow plants to colonize in a mosaic pattern creating better habitat and a more interesting wetland.

Depth

For emergent wetlands, at least half of the wetland should be less then 6" of standing water depth. The saturated upland-wetland edge should be as wide as possible as there is a great diversity of wetland plants that grow well in the area that remains saturated and only temporarily floods.

Slopes

For easy access and safety, the upland area leading down to the wetland and the bottom contour of the wetland should be sloped very gradually.

Construction

Conserving topsoil

Rototill or disk the footprint of the area being excavated for the wetland. Remove the top 4-6" which contains the topsoil and set this aside. Complete the excavation, then spread the topsoil layer across the bottom of the wetland. Conserving the topsoil will provide a much better planting medium then the subsoil. The reason for rototilling is the topsoil and sod would otherwise come up in large mats that will be nearly impossible to spread. The rototilling or discing can be done several days before the excavation date.

Erosion control

Be sure to purchase silt fence and or erosion control fabric before the construction day. The erosion control fabric should be used in spillways or swales where moving water could erode soils. Wetland vegetation should be planted for long term erosion control.

Clay liners

Lining a wetland creation site with clay is a good method to create ponded water if the existing soils are too well drained. The clay should be kept moist so it is easy to spread and not allowed to dry out after construction to prevent cracking.

IV. Planting Plan

You are now ready to begin making a plan to do some of the suggestions you made in the previous section. Hopefully, your suggestions included planting more plants in and around the pond. The next several steps will help you select plants and develop a planting plan for the site. If you are constructing or restoring a wetland you will need to get a design on paper in order to continue the planting plan.

A. Order Nursery Catalogs

Directions: Contact your local forester, native plant society or natural resource expert to get a list of nurseries that specialize in native plants. Native plant nurseries usually offer a greater selection of native plants then traditional landscape nurseries, Write a letter requesting a catalog. Complete this step several months before the planting time.

B. Determine Size of Planting areas

Directions: For wetland projects it is best to break the area being planted into several zones based on moisture. This will make it simpler to select plant species. Refer to the diagram on page __for an example of how Hollywood Elementary School divided their planting area into several zones. In this example one team of students was responsible for working on a planting design for one zone. The entire Hollywood Elementary School Project can be found in Appendix__.

1. Mark the boundaries of each planting zone with stakes. If the wetland has not been built yet but you have a plan on paper then mark the planting zones on the plan. You can then take the measurements right from the plan and convert them to the actual size.

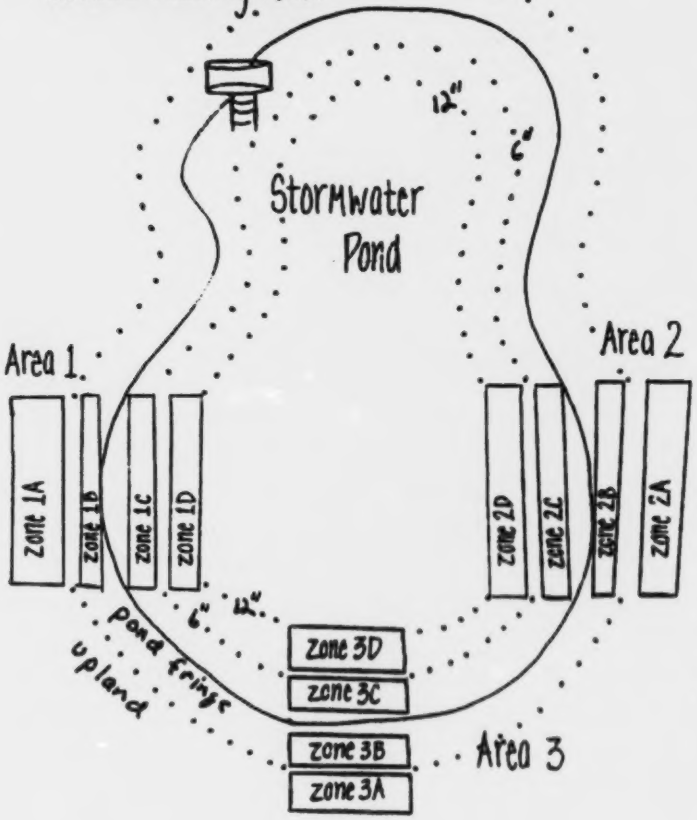
2. Measure the length and width of each area. If your area is not a rectangle, then develop a method to estimate the area.

Length (L)=_______
Width (W)=_______

Area= LxW

Area (A)=__________sq. ft.

Site: Hollywood Elementary School Wetland Planting Areas


Stormwater Pond
12"
6"
Area 1
Area 2
Zone 1A
Zone 1B
Zone 1C
Zone 1D
Zone 2D
Zone 2C
Zone 2B
Zone 2A
6"
12"
Pond fringe
upland
Zone 3D
zone 3C
zone 3B
zone 3A
Area 3

		Moisture	Plant types
Zone A	Upland Area	well drained to dry	shrubs & small trees
Zone B	Pond Fringe	moist to wet	shrubs & herbaceous plants
Zone C	Shallow Water	flooded up to 6" deep	herbaceous plants
Zone D	Deep Water	flooded 6" to 12" deep	herbaceous plants

	Size
Zone 1A:	20' x 42'
1B:	4' x 42'
1C:	8' x 42'
1D:	12' x 42'
Zone 2A:	8' x 53'
2B:	4' x 53'
2C:	6' x 53'
2D:	7' x 53'
Zone 3A:	12' x 28'
3B:	6' x 28'
3C:	4' x 28'
3D:	6' x 28'

C. Calculate the number of plants to order

Directions: In this step you'll figure out the number of plants to order. Use the Area (A) from the previous step and guidelines given for the distance (D) or spacing between plants. Use the following formula to figure out the number of plants to order.

$N = A \div D^2 \times 1.25$
N = number of plants
A = area in square feet
D2 = spacing between plants squared
1.25 = a factor that makes up for the loss of plants from ducks, vandalism, etc.

D= Spacing:
Herbaceous plants D= 2'
Shrubs and small trees D= 7'
Large trees D= 15'

Note: In the pond fringe area (zone c) both herbaceous plants and shrubs are used. Since the plants have different spacing requirements complete two calculations. For spacing on herbaceous plants use D= 2' for the shrubs use D= 7'. For example: if the zone c is 100 sq. ft. you would need 2 shrubs and 31 herbaceous plants.

$N = A\_\_\_\_\_\_\_\_ \div D^2\_\_\_\_\_\_\_\_\_ \times \underline{1.25}$

*N =_________

*Note: This number is a guideline for figuring out how many plants to order. Adjust the number based on the amount of money you have and the number of plants you will be able to plant and water.

D. Site Environmental Factors

Directions: In this step use the information gathered in the first section about the sunlight, moisture and soil at your site. If you have not done this yet, return to page __ and complete the steps. Summarize the information in the blank spaces below.

Sunlight________________
Moisture________________
Soil Texture_____________ Soil Compaction. yes? no?

E. Selecting Plants.

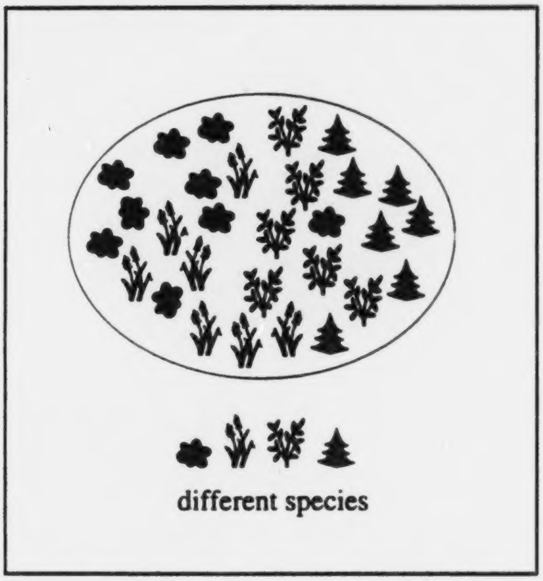
Directions: Use the information you gathered in steps C and D to help select plants. Review the example from Hollywood Elementary School on page__. Use the chart on the next page __ to list your plant choices.

Tips for selecting plants
1. Use only native plants.
2. Use the information about the environmental factors of the site to help with your selections- only include plants that will grow well in the site conditions you have.
3. Use nursery catalogs while selecting plants so that you do not select plants that are not available.
4. Some of the wetland plants spread rapidly while others spread slowly. Don't order as many of the rapidly spreading plants as they will fill in quickly
5. If you need 20 plants it is best to select 5-7 species instead of 20 different species. By doing this you can plant clusters of similar species making the planting more natural.

F. Planting Diagram

Directions: The next step is to create a planting diagram. Use the graph paper below or a separate piece of paper. The planting diagram will show how the plants are arranged and will be very helpful during the day you plant. The main thing to remember when making a planting diagram is to cluster similar species in groups. Use the adjacent diagram and the example from Hollywood Elementary School on page__ to help. Make a key to show where each species goes.

Common arrangement of plants in a natural setting



G. Plan Review.

Directions: In this step you will have your plan reviewed by an expert. This is called peer review. Most professionals doing habitat restoration have their plans reviewed by their peers or other experts. This is a very important step as they can provide advice on making your project better. Write a cover letter describing your project and asking for a review of your plan. Include your plant list and planting design.

H. Order Plants

Wetland plants are available in different forms. One form is a plug. Plugs are usually in peat pots or trays with many small plants per tray. Seedlings usually come in larger containers such as quart pots. Plugs and seedlings usually have leaves on them unless it is early in the year before the plants have sprouted. Another form is tubers or root cuttings. These are small pieces of the underground parts of the plant. Tubers and root cuttings can be pushed into the mud and a plant will sprout. If you order plugs or seedlings do not plant these in an area where the leaves will be covered with water. The leaves need to be out of the water in order for the plant to survive. Tubers and root cuttings can be planted underwater. The plant will send up a stalk to the top of the water then leaves will grow. Example: Suppose you order pickerel weed and want to plant it in up to 12" of water. If you order tubers or root cutting then you can plant them in up to 12" of water. If you order seedlings that are only 6" tall you can only plant them in shallow enough water where there leaves will be out of the water. If this is confusing, ask your nursery for help.

V. Planting Day

Directions: There are many details to figure out and materials to gather for planting day. Since each site and project is different it would be impossible to cover all the things you will need to do. The following is a general checklist to use as a guideline. Review the checklist and check the items that you will need to complete for your project. Add any additional items to the list. Decide on who will be responsible for completing tasks from the list.

Plants
____Order plants several weeks before planting day and arrange for pick up or delivery a few days before planting
____Have a safe, shady spot to store the plants until planting day
____Make sure the plants are kept watered until planting day
____Make sure all the plants are labeled

Materials
____Shovels, rakes, pick axes, hand trowels
____A method to water plants immediately after planting: hoses, buckets, empty milk jugs for watering
____Wheel barrows
____Mulch
____Compost
____Tree tubes (if needed)

Other
____Film and cameras
____Invite members of the community
____Invite the local newspaper or T.V. station (**Information on writing a press release included in the appendix**).

Checklist for School Wetland Project

Potential cooperators

_____Principal
____School faculty
____County school system facilities supervisor
____County school system grounds or maintenance supervisor
____School board
____PTA
____Nearby community
____Chesapeake Bay Trust
____U.S. Fish and Wildlife Service
____County Soil Conservation District
____Natural Resources Conservation Service
____County Public Works Department
____Local Contractors (parents)
____Garden Clubs
____Other groups

Steps

____Teachers and students do preliminary site survey
____Get permission to proceed from principal
____Follow up site survey with natural resource person
____Additional approvals (School board, school system maintenance and facilities coordinator)
____Wetland design
____Public relations campaign with parents and community
____Decide who will do excavation (contractor, parents, students)
____Make a plant list and planting design
____Excavate site
____Plant wetland
____Maintenance (watering, mulching and monitoring)

Excavation

____Topsoil needs to be saved. Roto-Till footprint of wetland and remove topsoil
____Closely supervise excavation
____Seed mix to stabilize disturbed area

Planning the planting day

____Water needs to be drawn down below planting area
____Recruit lots of adult volunteers (1 adult per 4 students)
____Show volunteers planting scheme and train on planting technique
____Order plants several weeks or months in advance
____Have plants delivered several days in advance
____Tools (shovels, rakes, pick axe, dibble bar, hand trowels, wheel barrows)
____Method to get water to site (hoses, buckets, milk jugs)
____Order mulch
____Organize student planting groups
____Invite media

Appendix

A. A Call for Action: *Where the Wild Things Are*

B. Habitat Componants

C. Developing a School Nursery

D. Writing a Press Release/Sample Press Release

E. Case Studys:
    Hollywood Elementary School
    Others

F. Why Use Native Plant/ List of Exotic Plants

G. Reference Material

H. Sources of Assistance

I. Planting Day Checklist

J. Planting Chart

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Washington Post April 22, 1996

Children

Where the Wild Things Are

Using Nature to Build Living & Learning Skills

By Laura Sessions Stepp
Washington Post Staff Writer

The man in the red cap with a quilted largemouth bass poking through it is explaining the rules for learning in the outdoors. "Stay behind me when we're walking," Mr. Bass tells the third-graders from a South Arlington school. "When we stop, I'll roll this out"—he produces a purple grosgrain ribbon—"and I want you to stand behind it."

Snap! Nine-year-old Darrius Hawkins breaks a skinny hickory branch with his hands. Snap! again. Magically, two sticks become four. While Mr. Bass, a.k.a. Neil Heinekamp, acting director of Arlington's Outdoor Lab, continues to talk, Darrius's eyes drift to a nearby stream where spotted salamanders have laid hundreds of eggs and tiny brown tadpoles have turned into frogs.

The roughness of tree bark, the gelatinous mass of amphibian eggs, even the tickle of a frog's legs as it hops across a palm . . . for most of human history, natural experiences such as these have been as much a part of childhood as food and shelter and scolding parents.

But over the last generation, opportunities for exploration of the natural world—particularly unstructured, playful exploration—have shrunk for many children even as a small but growing body of research shows such contact is important for healthy development. More and more, kids are playing indoors, leaving some experts to wonder whether this may help explain the dips in achievement, conduct disorders, signs of stress and acts of violence increasingly reported among U.S. children.

"Physical experiences are a significant part of brain development," says Laura Thurman, an early childhood education instructor at the University of Missouri's Child Development Center. "If we deny children these experiences we should not wonder why they're struggling in so many other areas."

One reason nature is such a successful laboratory for learning, social scientists say, is that it virtually begs young children to use their imagination and their hands, to take things apart and put them back together in new ways.

Psychologists call this "complex play" because of the multiple skills it uses, and they distinguish it from structured, rule-based games that require less original thinking.

[illegible] competency one can imagine: observing, inventing, problem-solving, decision-making."

Darrius Hawkins, 9, shows his enthusiasm for the Outdoor Lab scene.

education at Kutztown (Pa.) University. It also gives a child endless ways "to try something, fail, and try again."

Just being outdoors is not enough, however; grass and trees and small creatures are important too. William Sullivan, professor of environmental design at the University of Illinois, sent observers into a large housing development in inner-city Chicago to watch more than 200 children outside. According to his preliminary findings, kids on the blacktop or barren ground tended to stand around and talk, but on plots of ground with grass and trees they played.

For more than a decade educators have said that children learn best when they not only see a concept and hear it explained but also connect it to something with which they can experiment, something that allows them to touch, smell or taste.

Recent studies on the brain explain why this is so: The brain develops first through sensory experiences; later, words and other symbols also become important. "Smells and sights and sounds all become encoded as part of one experience," says Cosby Rogers, professor of child development at Virginia Tech University.

"The more often a young child uses all the senses, the more neurons are fired in his or her brain [illegible] ger when multiple senses are used, according to University of Oregon education professor

becomes increasingly sophisticated and re to learn more.

Several studies have suggested that na also has a capacity to help children pay at tion: Autistic children, for example, have b shown to become more focused if encoura to interact with dogs, cats, turtles and ot animals. In another study, the attentivenes young students in Swedish schools that offe easy access to nature was compared to attentiveness of students in schools that not provide such access. The former stud had fewer attention problems, according Stephen Kaplan, professor of psychology at University of Michigan.

The third-graders from Arlington's Glen lyn Elementary squat around a battered pickup, supposedly watching Mr. Bass dem strate how a screw works by jacking up truck's right rear tire. Simple machines are main lesson this day at the "lab," 200 acr Fauquier County forest. At this moment, ever, Stefany Miranda is more interest convincing a twig to stand upright [illegible] red clay. A nearby boy hands her a [illegible] pointed at one end and she succeeds in plan it. She places an oak leaf banner on top, nudges her friend. They exchange grins.

In class, old rules about competition achievement apply. So do divisions along der lines. Outside, the barriers break down their book "The Geography of Childhood: Children Need Wild Places," naturalists G Paul Nabhan and Stephen Trimble cite a st by Robin Moore, a planner who helped re sign an elementary school playground Berkeley, Calif. An asphalt playground modified to include a half-acre of fishing po streams, woods and meadows. Moore t spent time observing how the boys and played on both concrete and grass.

Boys and girls were more likely to together in the natural areas, he reported; asphalt "generated more conflict and str particularly between the sexes." Accordin Susan Miller, similar observations were m by teachers at an ethnically diverse schoo South Texas. The school enlarged its outd play area, adding a sand pit and water ta and planting vegetables and flowers. Child were given more time to play outside. teachers were surprised at how well the dren cooperated," she says.

Author Trimble attributes this [illegible] learning partly to the diversity [illegible] "Cone-nosed kissing bugs and star-[illegible] . . . skunks, fireflies and bats . . . The end forms generated by evolution subconscio [illegible] us of [illegible] validity," he writes [illegible] "Difference is the theme. Understanding di ence empowers us to grow and to care."

BEST COPY AVAILABLE

Natural settings reduce stress and boost mental and physical health among adults, many studies have shown, so it should come as no surprise that young people experience the same benefits. Yet children's participation in the outdoors is declining, according to the Outdoor Recreation Coalition of America.

Some of the reasons are obvious. Low-income parents keep children inside because it's safer; middle-income parents, because it's safer or more convenient. Television and computers entertain and baby-sit. When children do venture out, it's often to an organized outdoor function such as soccer, or to an indoor fantasy world such as Discovery Zone, the plastic playground concept that has spread to more than 300 franchised stores in six years.

While growing numbers of elementary schools are encouraging more outdoor learning, too many still keep kids indoors except for 15-minute recess periods, says education professor Miller. That's partly because teachers are not trained in college how to teach outdoors, says Susan Johnson, director of environmental education for the National Wildlife Federation.

As naturalist Michael Link writes in his book "Outdoor Education": "A classroom without walls . . . creates a [illegible] of unbridled behavior problems, students disappearing over the horizon in defiance and a general nightmare of unanswerable questions and uncatchable kids. The result is that most students receive formal education indoors and must then apply it to the outside world on their own."

Even children's knowledge about the outside world is learned largely indoors, according to Nabhan and Trimble. Nabhan cites a 1992 survey of fifth- and sixth-graders in which more than half of the children cited the media as their primary teacher about the environment. Roughly one out of three gave school the credit, and fewer than one out of 10 said they learned about the environment mostly at home or in the wild.

Nabhan and Trimble deplore this trend toward vicarious learning, saying children will not retain their knowledge of nor affection for the natural world in the same way that previous generations did.

Environmentalists look at the trend and wonder where future warriors in the environmental movement will come from. Most adults who feel an affinity for the environment developed that regard in childhood, they say. So what happens to children who don't have the same outdoor opportunities as previous generations? "What is the extinction of the condor to a child who has never seen a wren?" asks ecologist/author Robert Michael Pyle in the Nabhan-Trimble book.

Peter H. Kahn Jr., a psychologist, interviewed African-American children in inner-city Houston about their environmental views and found that although they were aware of environmental problems, few believed that Houston was polluted. "Houston is one of the most polluted cities in this country," says Kahn, who teaches at Colby College in Maine. "How could children who live there and know about pollution not believe it's there?"

To know that a place is polluted, a child needs to have seen unpolluted places, Kahn concluded. "It is imperative that we get kids out to experience nature, open space, less polluted states," he says.

Kahn's study helps dispel the notion, left from the early days of environmental politics, that nature studies are of little interest to low-income minority groups. True, the Houston children had pressing concerns about having enough to eat and where they could play safely. But they also "showed amazing diversity in the ways they appreciated and were committed to environmental issues," he says.

Environmentalists, child psychologists and others have advanced several ideas in recent years to increase outdoor opportunities for kids: schoolyard space transformed into natural habitats, parks built close to schools, public transportation provided to parks and park supervision increased.

But such efforts frequently get bogged down in adult debates over budgets and ideologies. School systems that attempt to weave outdoor education into their curricula, for example, sometimes find themselves caught between those who want to encourage kids both to think about the natural world and work on its behalf, and those who believe advocacy has no place in school.

Both camps do agree that children should be exposed to the natural world early and often, and that parents and grandparents are the best exposer/explainers. "It's important children understand their backyard first and gradually work outward," says Jo Kwong, an environmental research associate in Fairfax who is a critic of activism in the schools.

Naturalist Nabhan, a father of two, agrees: "We need not pretend we are [illegible] buddies with aloof predators. . . . Real attention given to a covey of quail, a swarm of termites, a litter of pack rats will do for most kids I know."

Billy Bale, left, and Joel Velasquez check out frogs with Outdoor Lab's Rex McLean.

A couple of days after their visit to the Outdoor Lab, Dorrian and three friends sit around a table at school and talk about what they liked about the field trip. The high points:

"When I touched the frog," says Joel Velasquez.

"The three turtles," says Victoria Moreno.

"Holding the snake," says Daniela Z[illegible]."

Dorrian is quiet. He is remembering the moment, near the end of the morning session, when he got a bit rowdy and earned a strong reprimand from his teacher, Scott Cleveland. At the time he stalked off, and sat on a hillside overlooking a pond.

"I felt sad, like my heart stopped beating," he recalls later in school. But he says that as he sat there, he imagined swimming in the pond with swift, sure strokes. A few minutes later he was able to rise and join the group.

He remembers that moment too. "I felt happy," he says. "Like my heart was beating really fast."

BEST COPY AVAILABLE

B. Habitat Componants

The main focus of your habitat restoration project should involve planting native plants to create more habitat. In addition, there are many other wildlife habitat management techniques, and other things that can be done to make your habitat more attractive for wildlife and people. The following is a list with brief descriptions. Check your library or the internet for more specific information.

Water: If you don't have room for a wetland or pond, then think about a way to provide water for wildlife. Filling half barrels or cement mixing troughs with water works well. If your soil has a lot of clay, simply dig a few shallow holes with a shovel and let the rain fill them. If you can figure out a way to allow water to drip into a puddle this can be irresistible to birds. If your interested in a small lined pond check your library or nursery for a set of directions.

Trails. Trails should be an integral part of any habitat project. Make sure wheel chair access is incorporated into train design. You may decide to create a nature trail that will eventually wind throughout the entire schoolyard. Trails placed through reforestation areas, meadows, forests, near wetlands, butterfly gardens, and bird feeders will allow more students and teachers to use the enhanced natural area. Regularly mowed grass trails are easily maintained in sunny areas. To make the trail convenient for mowing, make it the same width as the tractor/mower. Wood chips are a good ground cover for wooded trails. Many tree maintenance companies will provide free wood chips for your project.

Bluebird trail. Place a series of bluebird houses at least 100 yards apart, preferably along a forest edge or in a meadow. Boxes need to be built and placed on posts with predator guards. Boxes should be monitored and cleaned after each brood. Many birds may use bluebird boxes for nesting. All birds, except house sparrows and starlings, are protected by law.

Wildlife feeding. Place bird feeders near protective shrubs and trees to attract more birds. Build a wildlife observation blind near feeders for closer observation of birds. Bird feeders can be built from a variety of material. A bird feeder project should have some long-term benefit for the students and not be a one-time project.

Wildlife gardens. A garden can be planted to attract butterflies, hummingbirds and a host of other insects, spiders and birds. Butterflies prefer sunny areas protected from the wind. Before planting a garden, decide what level of maintenance you want to achieve. Maintaining a garden requires much more work then maintaining natural habitats. Many of the same butterfly attracting plants can be used in a meadow, wetland or woodland restoration project.

Logs. Rotting logs are habitat for many insects salamanders and small mammals. Logs are good lessons in the process of decay and the life associated with it. Logs can be placed in any of the habitat types. Partially submerged logs in wetland or pond projects provide a place for turtles and frogs to sun.

Snags. Standing dead trees or snags provide for cavity nesting birds including woodpeckers and chickadees. Insects within snags attract a variety of birds. Raptors or predatory birds perch on snags for a better view of prey.

Brushpiles. Piled up tree cuttings or old Christmas trees make good brushpiles. Rabbits, chipmunks, skunks, small birds, and insects utilize brushpiles. Place brushpiles in woodlands and along wooded edges. See page [illegible] for specific information.

Wildlife tracking box. A wooden box filled with mud or modeling clay and placed near water or a feeding area makes a good tracking box. Visiting animals will leave tracks which students can identify, make plaster castings of, write stories about, etc.

Wildlife observation blind. A simple structure with a solid wooden wall with slats cut out at eye level will allow students to view wildlife on the other side. It should be placed in front of bird feeders, bird bath or small pond, and butterfly gardens for closer observation of birds and insects.

Tree nursery. Nuts, seeds and fruits and cuttings can be collected and planted by students. Seedlings can be later transplanted around the school, community, or taken home by the students. Your forester or local horticulturist may be able to provide suggestions. See the article on page xx.

Outdoor Classroom. An area where class can be held outside. Ask faculty members how and if they would use an outdoor classroom. Picnic tables work well and can be used as work stations. Place in an area that is easy to access from school. Hillsides are a good place for a small amphitheater.

Composting. Large or small scale composting can be used to teach many lessons.

Signs. Identifying your project with signs help with community recognition.

D. Writing a Press Release

A press release is a way to inform television and radio stations and newspapers about an issue or an event. It presents facts clearly, briefly and completely. A press release should contain enough information so that it can be used without the newsperson calling back for more facts.

Before writing the press release decide what is the purpose of the release and what are the most interesting aspects of the story. Make sure you have verified all spellings, figures, full names and titles.

The first paragraph should contain the "five W's" These are answers to the basic questions who, what, where, when and why and sometimes how. Additional paragraphs can provide more detailed information. When writing a press release, keep the following in mind:

1. The press release should capture the attention of a reporter or editor
2. Tell the most important part of the story in the lead (first paragraph)
3. After the lead elaborate on details
4. Keep press releases short (40 or less sentences)
5. Follow the basic style below

Stationary: For the first page use letterhead stationary (if available). If not, use white bond, typing paper with the name and address of the person or organization issuing the release and the words "News Release" or "Media Alert" in the upper left hand corner.
Release time: Flush left and underlined, type "For Release on" and add the date you want the press to see the release or type "For immediate release"
Contact: Flush right, type name and phone number of a person the press can contact for more information
Title: Centered, all capital letters underlined; identifies content of the release
Body: Double spaced, first sentence of each paragraph should be indented. Do not break sentences or paragraphs between pages. For releases longer than 1 page, the word "more" in parentheses should be centered at bottom of first page, end releases with 3 x's (with spaces between) centered at the bottom.

Name of organization
Address of organization
News Release

For release on (month, day year) Contact: Name of person
or For immediate release Phone number

TITLE

Lead Paragraph answering the 5 W's
More detailed information in following paragraphs

Sample Press Release

U.S. Fish And Wildlife Service • Chesapeake Bay Field Office

NEWS

---

177 Admiral Cochrane Drive • Annapolis, Maryland 21401 • (410) 573-4500

MEDIA ALERT

For more information, contact:
Linda Taylor (410) 573-4550

November 9, 1995

Volunteers Restore Forest Habitat at Pickering Creek Environmental Center

On November 14, from 9:00 am to 12:00 pm, members of the National Civilian Corps and volunteeers from the Pickering Creek Environmental Center will plant 500 trees and shrubs at the Pickering Creek Environmental Center in Talbot County, Maryland. The tree planting is part of the U. S. Fish and Wildlife Service's **Partners for Wildlife** program. Other partners include the Pickering Creek Environmental Center, Alliance for Chesapeake Bay, Environmental Concern, Inc. and Maryland Department of Natural Resources.

The project area includes a small nontidal pool, a forested wetland, and a 50 foot buffer strip linking two forests. Once completed the new forested area will provide habitat for wildlife while improving the water quality of the stream. The planting site will serve as a demonstration of the compatability of agriculture and wildlife habitat. The site will become an active part of the educational program at Pickering Creek Environmental Center.

Directions: From Annapolis take Route 50 East, go past Route 213 and Route 404, turn right onto route 662 , turn right onto Sharp Road, take a sharp right along Sharp Road, look for sign for Pickering Creek Environmental Center. Site is at the end of the driveway. From Easton take Route 50 West, Turn Left onto Route 662, turn left onto Sharp Road, take a sharp right along Sharp Road, look for sign for Pickering Creek Environmental Center. Site is at the end of the driveway.

The Partners for Wildlife program improves fish and wildlife habitat on private land through alliances between the U.S. Fish and Wildlife Service, other organizations, and individuals, while leaving the land in private ownership.

Julie Tracy and Mary Roderick
Hollywood Elementary School
160 Joy Chapel Road
Hollywood, Maryland 20636
(301)373-2292

A Habitat Restoration Project: Planting Wetland Plants in a Stormwater Management Pond

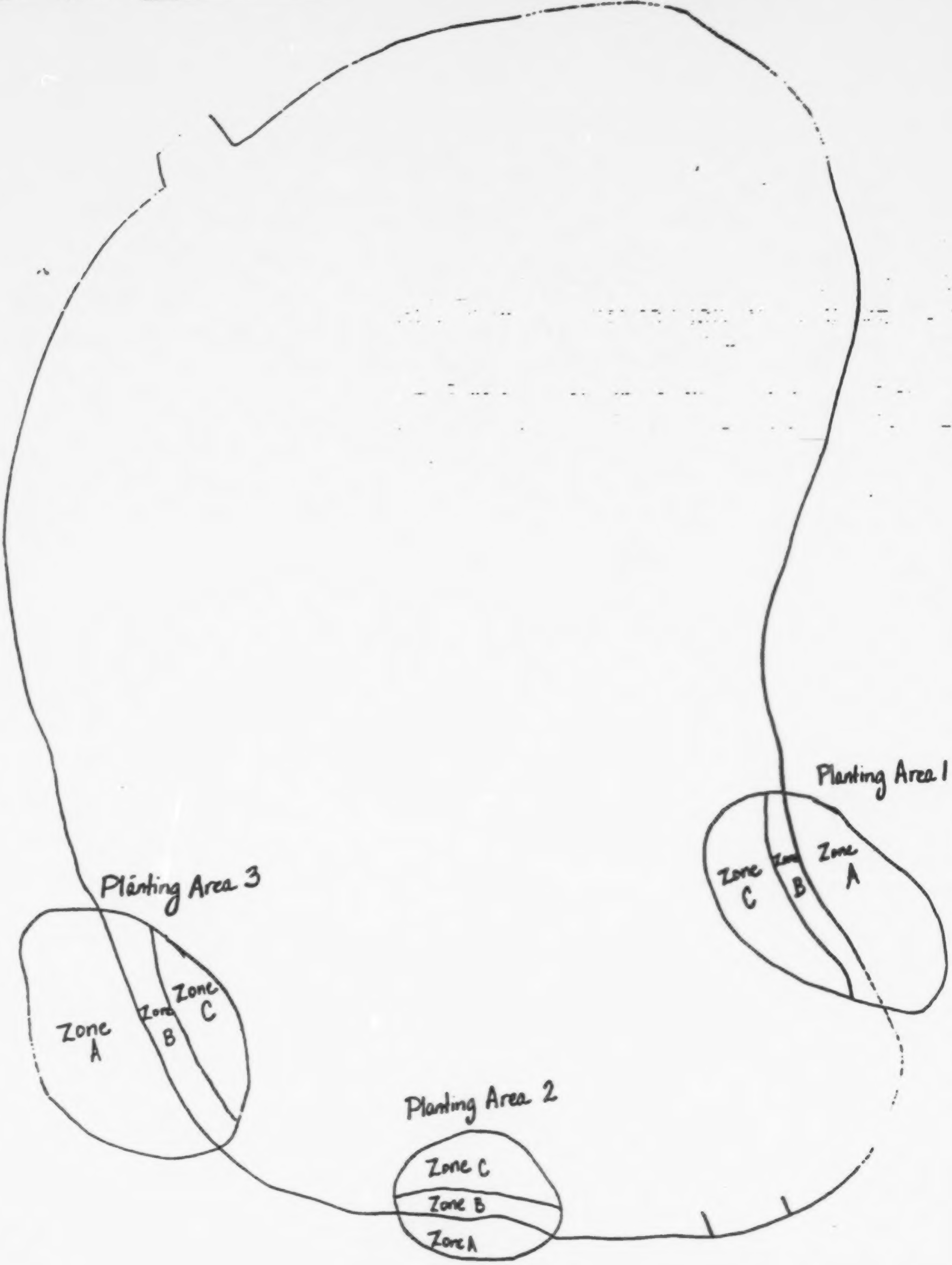
Student Agenda:

I. Stormwater Management Ponds
   A. Read background information.
   B. Observe stormwater management pond on school site.
II. Wetlands
   A. Read background information.
   B. Complete Wildlife Habitat Survey.
   C. Develop Plan of Action.
III. Develop planting plans for each zone.
   A. Study examples of wetland plantings done at other schools.
   B. Calculate the areas of the planting zones.
   C. Calculate the number of plants needed for each zone.
   D. Select the plants to be planted in each zone.
   E. Draw a map of the planting plan for each zone.
IV. Submit plans to Mr. Rich Mason for his recommendations.
V. Invite Ms. Laurissa Brantley to teach students how to fill out the Chesapeake Bay Trust grant application form.
VI. Complete the grant application form.
VII. Plant the wetland plants.
VIII. Observe the pond.
IX. Write thank-you letters and tell about their observations to Mr. Mason and Ms. Brantley.
X. Continue to monitor the pond. Complete the Wildlife Habitat Survey again.

Team Number: ____

Team Name: ________

Hollywood Elementary
Planting Zones in Our Pond


Planting Area 1
Zone C
Zone B
Zone A
Planting Area 3
Zone A
Zone B
Zone C
Planting Area 2
Zone C
Zone B
Zone A

Name: Jennifer Green

Team Number: 4

Team Name: Slaphappy

Zone 1C

Plant Species	Water Tolerance	Sun	Number of Plants Needed	Cost	Notes
Blue Flag Iris	0-6 inches	○ ◑	15 Blue Flag Irises	.85 1.50 = .85 $12.75	Blooms all year
Sweet Flag	0-2 ft.	◑	14 Sweet Flags	.28 .65 1.50 = .65 = $9.10	(blooms all year) Near midtide
Lizards Tail	1 ft	◑	14 Lizard's Tail's	.88 1.50 = .90 $12.60	Near midtide
Spatterdock	1-3 ft	◑	14 Spatterdocks	1.50 = $21.00	Spreads slowly
Duckpotato	0-2 ft	◑	14 Duckpotatos	.28 .65 1.50 = .65 = $9.10	(Spreads rapidly) Blooms all year
				Total = $64.55	

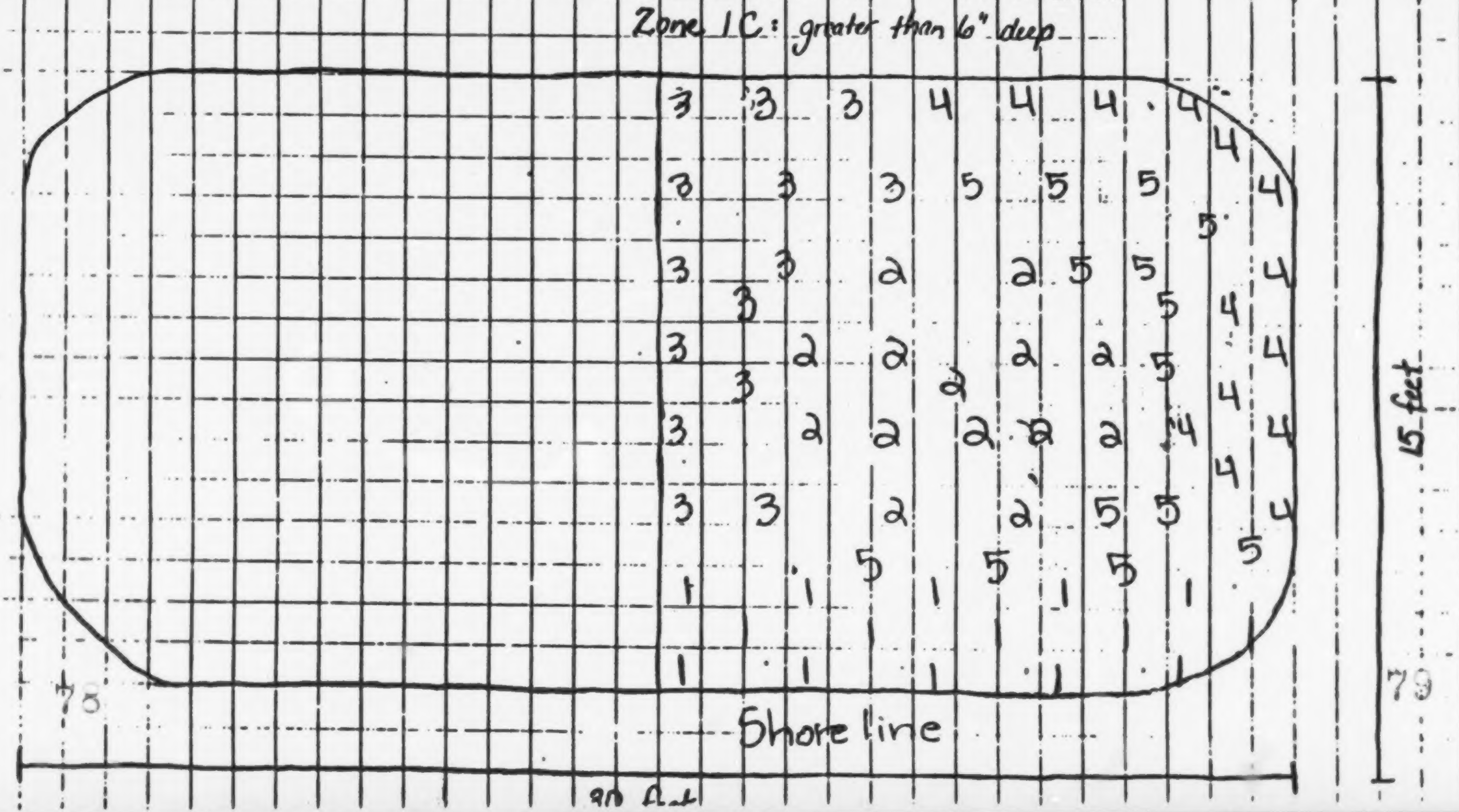
Name: Jenny Green

Team Number: 4

Team Name: Slaphappy

KEY

Blue Flag Iris = 1
Sweet Flag = 2
Lizards Tail = 3
Spatterdock = 4
Duck potato = 5


Zone 1C: greater than 6" deep
3 3 3 4 4 4 4
4
3 3 3 5 5 5 4
5
3 3 2 2 5 5 4
3 5 4
3 2 2 2 2 5 4
3 2 4
3 2 2 2 2 2 4 4
4
3 3 2 2 5 5 4
5 5 5 5
1 1 1 1 1
1 1 1 1
Shore line
15 feet
30 feet

Hollywood Elementary S
160 Joy Chapel Rd
Hollywood, MD 20636
April 5, 1995

Dear Mr. Mason,

We are 3rd and 5th graders in Hollywood Elementar School. As you know, we are very interested on plants and wetlands. We are working on fixing our school pond to atract m wildlife and having a better habitat for wildlife. We have hal of the zone 1C. We have chosen 5 different kinds of plants to put in our zone. Here are the plants: 15 Blue Flag Irises, 14 Sweet Flags, 14 Lizards Tails, 14 Spatterdocks, and 14 Duc potatos. The total number for our half is 71 plants. We chose the because our water height is greater than 6" deep. All of th plants can tolerate this. We chose all of these plants because they will atract more wildlife and give food to animals. We especially chose the Spatterdock to give shade because of it's big leaves and we chose the Blue Flag Iris because it is very attractie. We are looking forward to your response and hope you can help us.

Thanks,

Jennifer, Charlie, Keyonnda
Joshua Carter

Jennifer, Charlie, Keyonnda, Joshua Carter

W. Chew Ave. P.O. Box P
St. Michaels, Maryland 21663
(410) 745-9620

2688

Rich Mason

ame Hollywood Elem. School Date 4/28/95

ddress 160 Joy Chapel Rd.
Hollywood, Md 20636

old By	Cash	C.O.D.	Charge	On Acct.	Mdse Retd.	Paid Out

UAN.	DESCRIPTION	SIZE	PRICE	AMOUNT
50	Juncus effusus	BR	.50	25.00
50	Pickerelweed	PP	1.10	55.00
40	Duck potato	PP	.65	26.00
14	Giant burreed	BR	.90	12.60
30	Spatterdock	BR	1.10	33.00
10	Lizardtail	BR	.75	7.50
30	Blue flag	BR	.85	25.50
30	Sweet flag	BR	.60	18.00
30	Threesquare	PP	.85	25.50
20	Soft Stem bulrush	BR	.85	25.50
7	Lobelia	qt	1.75	12.25
20	Carex stricta	qt	1.60	32.00
5	Joe pye weed	qt	1.60	24.00
9	Hibiscus	qt	2.00	18.00

Page 1 of 2

Environmental Concern Inc.
210 W. Chew Ave. P.O. Box P
St. Michaels, Maryland 21663
(410) 745-9620

2689

Rich Mason

Name Hollywood Elem. School Date 4/28/95

Address

Sold By	Cash	C.O.D.	Charge	On Acct.	Mdse Retd.	Paid Out

QUAN.	DESCRIPTION	SIZE	PRICE	AMOUNT
15	N.Y. Ironweed	qt	1.60	24.00
15	Swamp milkweed	qt	1.60	24.00
2	Persimmon	2-3'	8.00	16.00
6	Shadbush	2-3'	8.00	48.00
6	Elderberry	2-3'	7.00	42.00
52	Mountain laurel		N/C	
	delivery			

page 2 of 2

F

B. Why Use Native Plants?

Native or indigenous plants are adapted to the local soil, rainfall and temperature conditions, and have developed natural defenses to withstand many types of insects and diseases. Because of these traits, native plants will grow without a lot of maintenance. Wildlife species evolve with plants; therefore, they use native plant communities as their habitat. Using native plants helps preserve the balance of natural ecosystems. In contrast, many natural ecosystems have been degraded by exotic, or non-native plants introduced from other parts of the world. Some of these introduced plants are invasive, meaning they do not have any natural controls. Invasive plants can spread rapidly and smother native vegetation. Ecosystems impacted by invasive exotic plants have less wildlife and plant diversity than unaffected systems. A list of invasive exotic plants to avoid is provided in theInvasive Exotic Plants

Invasive Exotic Plants of the Mid-Atlantic.
The following is a partial list of exotic plants known to be invasive in parts of the Mid-Atlantic region. All of these plants should be removed imediately when identified. It is helpful to have a plant expert visit your site periodically to help identify exotic invasive plants.

Trees

- Norway maple *(Acer platanoides)*
- Sycamore maple *(Acer pseudoplatanus)*
- Tree of heaven *(Ailanthus altissima)*
- Russian olive *(Elaeagnus angustifolia)*
- Autumn olive *(Elaeagnus umbellata)*
- White mulberry *(Morus alba)*
- Empress tree *(Paulownia tomentosa)*
- Sweet cherry *(Prunus avium)*
- White cottonwood *(Populus alba)*

Shrubs

- Japanese barberry *(Berberis thunbergii)*
- Winged euonymus *(Euonymus alatus)*
- Privet *(Ligustrum obtusifolium)*
- Bush honeysuckles *(Lonicera spp.)*
- Common buckthorn *(Rhamnus cathartica)*
- European buckthorn *(Rhamnus frangula)*
- Multiflora rose *(Rosa multiflora)*
- Japanese spirea *(Spiraea japonica)*

Vines

- Porcelain berry *(Ampelopsis brevipedunculata)*
- Oriental bittersweet *(Celastrus orbiculata)*
- Climbing euonymus *(Euonymus fortunei)*
- English ivy *(Hedera helix)*
- Japanese honeysuckle *(Lonicera japonica)*
- Mile a minute vine *(Polygonum perfoliatum)*
- Kudzu *(Pueraria lobata)*
- Periwinkle *(Vinca minor)*
- Japanese wisteria *(Wisteria floribunda)*

Herbaceous Plants

- Five leaf Akebia *(Akebia quinata)*
- Garlic mustard *(Alliaria petiolata)*
- Giant reed *(Arundo donax)*
- Asiatic sound sedge *(Carex frutescens)*
- Spotted knapweed *(Centaurea maculosa)*
- Canada thistle *(Cirsium arvense)*
- Bull thistle *(Cirsium vulgare)*
- Crown vetch *(Coronilla varia)*
- Chinese yam *(Dioscorea batatas)*
- Chinese lespedeza *(Lespedeza cuneata)*
- Purple loosestrife *(Lythrum salicaria)*
- Eulalia *(Microstegium vimineum)*
- Aneilimia *(Murdannia keisak)*
- Beafsteak plant *(Perilla frutescens)*
- Common reed *(Phragmites australis)*
- Japanese knotweed *(Polygonum cuspidatum)*
- Johnson grass *(Sorgum halepense)*

G. Reference Material:

The following is a limited list of references from the thousands available.

School Habitat Restoration Materials

Cheskey, Edward D. *Habitat Restoration: A Guide for Proactive Schools*. The Waterloo County Board of Education. 1993.

Outdoor Wildlife Learning Sites, Guidelines for Kansas Schools. Kansas Department of Wildlife and Parks.

Schaefer, Joseph M., Donelin, Dan W., Linscott, Lester L., Cronin-Jones, Linda. *Schoolyard Ecosystems for Northeast Florida, A Guide for Planning, Installing, Maintaining, and Using*. Florida Advisory Council on Environmental Education, Tallahassee, Florida. 1992.

Schiff, Paul, Smith-Walters, Cindi. *Wild School Sites, A Guide to preparing for Habitat Improvement Projects on School Grounds*. Western Regional Environmental Council, Inc. 1993.

So You Want to Start an Outdoor Classroom. The Oklahoma Conservation Commission and The Oklahoma Department of Wildlife Conservation, Oklahoma City, Oklahoma.

Wyzga, Marilyn C. *Homes for Wildlife, A Planning Guide for Habitat Enhancement on School Grounds*. New Hampshire Fish and Game Department.

Habitat Restoration References

Brittingham, Margaret. *Providing Wetlands for Wildlife While Controlling Stormwater*. Pennsylvania State University, College of Agricultural Sciences Cooperative Extension.

Firehook, Karen, Doherty, Jacqueline. *A Citizen's Streambank Restoration Handbook*. Save Our Streams Program, Gaithersburg, Maryland. 1995.

Sotir, Robbin B., Gray, Donald H. *Soil Bioengineering for Upland Slope Protection and Erosion Reduction*. U.S. Department of Agriculture, Soil Conservation Service. 1992.

Resources on using the schoolyard to teach

Kesselheim, Alan S., Slattery, Britt Eckhardt, Higgins, Susan H., Schilling, Mark R. *WOW! The Wonders of Wetlands*. Environmental Concern, Inc and The Watercourse. 1995.

Pond Watchers, Guide to Ponds and Vernal Pools of Eastern North America. Massachusetts Audubon Society, Lincoln, Massachusetts. 1995.

General Reading and other references

Leopold, Aldo. *A Sand County Almanac*. Ballantine Books, New York, New York. 1949.

Stein, Sara. *Noah's Garden, Restoring the Ecology of Our Own Back Yards*. Houghton Mifflin Company, New York, New York. 1993.

Plants

Martin, Alexander C., Zim, Herbert S., Nelson, Arnold L. *American Wildlife and Plants, A Guide to*

Wildlife and Food Habits. Dover Publications, Inc., New York, New York. 1951.

Mowery, Marci. *Native Plants in the Creation of Backyard, Schoolyard and Park Habitat Areas.* Audubon Council of Pennsylvania, Camp Hill, Pennsylvania. 1995.

Mason, Rich, Hitchcock, Jason. *Native Plants for Wildlife Habitat.* U.S. Fish and Wildlife Service, Annapolis, Maryland. 1995

Note: Have alot more to add.

H. Sources of Assistance: not completed

I. Planting Day Checklist

____Mark planting area. In order to avoid having your new plants mowed over it is highly recommended to mark the boundaries of the planting area with stakes (preferably large stakes that can't be pulled out or run over with a mower). One option is to use treated 8'-4x4 posts, cut them in half and paint "no mowing/wildlfe habitat". Bury each post at least 1' in the ground. See the diagram on page __ for an example.

Plants
____Order plants several weeks before planting day and arrange for pick up or delivery
____Have a safe spot to store the plants until planting
____Make sure all the plants are labeled
____Water plants regularly until planting

Materials
____Shovels, rakes, pick axes, hand trowels
____A method to water plants immediately after planting: hoses, buckets, empty milk jugs for watering
____Wheel barrows
____Mulch
____Compost

Other
____Invite members of the community
____Invite the local newspaper or T.V. station (**Information on writing a press releases included in appendix __).**

4A: Woodlands

HISTORICAL RESEARCH RESOURCES

General Land Office Survey Plats (Series 698).

Surveyors employed by the United States General Land Office surveyed Wisconsin circa 1830-1870. A product of these surveys was a series of maps of individual townships showing basic topography and some cultural features such as roads, trails, Native American sites, mines, dams and cultivated areas. These maps were deposited in the regional land offices and were used by land buyers to select properties. These maps are the first detailed and reasonably accurate maps of Wisconsin. They can be used to reconstruct topography and to locate historical and archeological sites.

General Land Office Surveyors' Notes (series 701).

The General Land Office surveyors were required to make notes about soil, vegetation and cultural features they observed as they carried out the surveys. These notes are in the form of small notebooks arranged by township. The Historical Society has microfilmed copies of the original notes. Research uses include reconstruction of historical vegetation and topography and identification of historic and archeological sites.

General Land Office Tract Books (Series 1673).

These books record sales of land by the Federal Government to the first purchasers. The records include names of purchasers, amount of land purchased, legal description of the property, price paid and date of purchase. Research uses include tracing the history of a property and identifying settlement patterns.

United States Geological Survey Topographical Maps.

The Geological Survey mapped from the late 1890's through the mid 1980's. Maps are available in three series at scales: of 1:24,000; 1:48,000 and 1:62,500. The first series covers the entire state and ranges in date from the late 1940's to the present with continuing revisions. The other two series include maps dated as early as 1900, but only cover a small part of the state. The outstanding characteristics of the topographical maps are their large scale, accuracy and detail, including contours, elevations, place names, vegetation and civil boundaries. Because these maps cover a broad time range and have been revised on a fairly regular schedule, they are useful for assessing changes in the environment.

Plat Maps and Atlases.

Plat maps and atlases are usually restricted to one county and show names of rural landowners and boundaries of individual properties. Plat maps and atlases of the nineteenth century often include illustrations of individual farmsteads and business premises, maps of cities and villages, and locations of schools and cemeteries. Twentieth century versions are usually much simpler.

Sanborn Insurance Maps.

Snaborn maps are extremely detailed and large-scale maps of cities and villages ranging in date from the 1880's to the 1970's. These maps show the exact size, placement and construction of every building on each city block, and its use (residential, retail, manufacturing). Since most cities were mapped several times at intervals of five to ten years, the Sanborn maps show the development of neighborhoods and can also be used to identify environmental hazards.

Public Land Survey   Survey of the Northwest Territories
Established by the land ordinance of 1785

First survey began in Ohio in 1786 -- Last finished in Wisconsin in 1860's
Purpose - to divide land into six mile square blocks called townships. Each township divided into one mile square SECTIONS.

Surveyors used compass and chains. Chain was 66 feet long.

First they divided land into townships marking every half mile or 40 chains.
They noted trees in the line and witness trees for the setting of posts or monuments.

Sections divided into quarter sections of 160 acres. In 1862 Homestead Act, congress allowed settlers a quarter sections of land free by settling on it for five years in new territories.

Original notes show where bearing trees are, in relationship to the markers. *i.e. "Set post WO12, n14 E60"* means they blazed a tree which was a white oak, 12 inches in diameter, bearing north, 14 degrees East, 60 links away.

A Prairie Year

A Play of Prairie Phenology for Elementary Students

Each student should have a card with a picture of a prairie plant. The plants included here are:

Bergamot
Big Bluestem
Blackeyed Susan
Butterfly Weed
Compass Plant
Goldenrod (Stiff)
Indian Paintbrush
Little Bluestem
Lupine
New England Aster
Pasque Flower
Prairie Dock
Purple Coneflower
Spiderwort
Yellow Coneflower

It is cold winter. The days are cold and short. Nights are long. To us humans, the prairie looks dead. All above ground portions of the plants are brown and dead.

But underneath, the roots are quite alive.

(All students should be in a group and crouched down. They are the roots of their plant)

You are our prairie, your roots are alive but you can imagine a blanket of snow over your heads. And blanket is a good word for it as the covering of snow and soil keeps the roots warm and unfrozen.

Then the days start to get warmer and longer. The snow melts, the soil warms. Plants start to grow and leaves start to emerge from the ground.

Students start to sit up a bit. As their plant blooms, they stand up and put their card over their head. When their plant sets seed, they put their hands down but stay standing)

Now it is April

	BLOOMS	STOP BLOOMING, SET SEED
April	Pasque Flower	
May	Lupine Indian Paintbrush *(Shooting Star)*	Pasque Flower

PRAIRIE SPECIES SELECTION WORKSHEET

This worksheet is a guide to help you select species for your prairie mix. Use the "Wisconsin Prairie Species List" from "Prairie Restoration for Wisconsin Schools" with this worksheet. To begin, identify your site and requirements, then determine what plant characteristics will fit your site and needs. Circle or take note of those characteristics on this sheet. Next, use the "Prairie Species List" to choose the species that fit your requirements. List those potential species on the accompanying form. You may need to adjust the number of species for your mix depending upon budget, availability and size of your prairie. A minimum of 15 forbs and 3 grasses are required for a prairie restoration. The goal is to have a new flower come into bloom every week during the growing season -- about 30 forbs plus grasses. A prairie mix can include many more species. Curtis Prairie, at UW-Madison Arboretum, has 300 species.

Site Characteristics

School: ______________________________

Prairie name: ______________________________

Prairie Area : __________ (sq. ft)

Soil Classification: Sandy Loam Clay

Topography: Steep gently rolling level low areas high areas

Prairie Specie Characteristics

1. **Type of Prairie:** **Dry** Dry Mesic **Mesic (medium)** Wet Mesic **Wet**
2. **Light:** Full sun Partial shade Shade
3. **Height:** Less than 4' (shortgrass prairie) Greater than 4' (tallgrass)
4. **Grasses:**
5. **Phenology** (time of bloom): (Choose plants for a continuous bloom)
   - Spring
   - Early Summer
   - Summer
   - Late Summer
   - Fall
6. **Color:** Look for color combinations and contrasts within each blooming interval.

HOW MUCH SEED DO YOU NEED?

This worksheet is a guide to help you estimate the amount of seed you need for planting your prairie. It is based on a planting density of 60 seeds per square foot (or about 20 lb. per acre), and it adjusts for the introduction of individual plants.

1. Number of square feet to be planted: __________
2. Number of plants to be used: __________
3. Number of square feet to be used for seed calculations (subtract #2 from #1): __________
4. Ounces of seed needed (multiply #3 by 0.00735) __________
5. If you are using Arboretum research seed mix, subtract 5 oz. from #4. Otherwise, enter #4: __________
6. Number of grass species to be planted from seed: (excluding Arboretum seed mix) __________
7. Number of forb species to be planted from seed: (excluding Arboretum seed mix) __________
8. Proportion of grass desired in seed mix: __________
9. Proportion of forb desired in seed mix: __________
10. **Ounces of grass seed needed:** (multiply #5 times #8) ______oz.
11. **Ounces of forb seed needed:** (multiply #5 times #9) ______oz.

Note on calculations: 0.00735 oz/sq ft = 320 oz/acre = 20 lb/acre = approximately 60 seeds/sq ft

HOW MUCH WILL IT COST?

If you buy seed from a retail supplier, you may estimate approximately $60 per ounce of seed. So total cost in dollars equals #5 (above) times $60. Remember that cost varies according to species, so your actual cost will depend on which species you choose to plant, and how much of each.

Note: If a retail catalog gives planting recommendations in lb per acre, you can multiply by 0.3673 to convert to oz per 1000 sq ft.

1/95

PRAIRIE SPECIES MIX FORM

This form is the final version for your prairie species mix. Use this to indicate the desired proportion of species you want, how much seed or number of plants you will need, and your sources and cost.

Criteria* for desired proportions of species:

1. **Grass / forb ratio.** Usually 50/50.
2. **Aggressive species.** Use a smaller proportion in your mix.
3. **Visibility and visual essence.** Consider color and showiness of species. Be careful not to let strong colors dominate the prairie scene. Inconspicuous flowers provide a unifying effect in the prairie. The bright colors are the accents. Look at the spatial characteristics of species -- some form colonies, others spread randomly. Limit the proportion of species that form colonies in a small scale prairie, increase the proportion in a large prairie.
4. **Look at the amount of seed in relation to weight.** There are fewer large seeds in an ounce (or gram) so you need a larger proportion to equal the same amount of a lighter weight seed.

* See "Prairie Restoration for Wisconsin Schools" pages 24 - 27.

WS = Wet Stratification. Mix seeds with moist sawdust, vermiculite or clean sand and store at 34° - 38° F. Species with this type of treatment may germinate without stratification, leading some to conclude that no treatment is necessary. Often seed germination will be enhanced with stratification.
WWS = Warm Wet Stratification. Mix seeds with moist sawdust, vermiculite or clean sand and store at 50° - 60° F.
DS = Dry Stratification. Store seeds in unheated shed or garage overwinter.
Sc = Scarification. Scratch seed coats.
In = Inoculate with rhizobium bacterium (applied to legumes).
Fr = Plant fresh seed.
Fa = Plant seed in fall.
-ES = Plant seed in early spring, seed germinates best with cool soil temperatures.
-Wa = Plant seed when soil temperatures are warm.
-Lt = Seed germination is improved with light, do not cover seeds, simply firmly press into soil.
( ) = Number of days for treatment.
H20 = Hot water treatment. Soak seed in boiling water for 1-2 minutes.

Examples:

WS(30-60) = Wet stratify seed for 30-60 days
WWS(90)/WS(90) = Warm wet stratify seed for 90 days followed by cold wet stratification for 90 days
WS(60)-ES = Wet stratify seed for 60 days and plant in early spring.
WS(30)-Wa = Wet stratify seed for 30 days and plant when soil temperatures are warm.
WS(30)-Lt = Wet stratify seed for 30 days, do not cover seed when planting
WS(30-60),In,Sc = Seed should be scarified and inoculated and wet stratified for 30-60 days.
H20+WS(90) = Soak seeds in hot water for 1-2 minutes followed by 90 days cold wet stratification.

Comments Code

Rh = Rhizomatous species
SL-Per = Short-lived perennials
Weedy = Not recommended for planting. May come in without planting

References

Henderson, R.A. 1993. Plant Species Composition of Wisconsin Prairies: An Aid to Selecting Species for Plantings and Restorations. WI DNR

Wade, Alan, 1993. Prairie Moon Nursery Catalog and Cultural Guide

WISCONSIN PRAIRIE SPECIES LIST

Scientific Name	Common Name	Bloom	Color	Height	Habitat	Light	Germination Tmt	Comments
Achillea millifolium	Yarrow	Jun-Oct	Wht	8"-40"	PD-PW	Su	DS or WS(30)	Rh, SL-Per
Agalinis aspera	Rough false foxglove	Aug-Sep	Pnk-Pur	16"-32"	PD-PW	Su		
Agalinis gattingeri*	Gattingers false foxglove	Aug-Sep	Pnk-Pur	16"-32"	PWM	Ps,Su		
Agropyron trachycaulum	Slender wheatgrass			1'-3'	PDM-PWM	Su,Ps,Sh	DS	
Allium canadense	Wild garlic	May-Jun	Pnk	6"-24"	PDM-PWM	Su,Ps	None	
Allium cernuum	Nodding wild onion	Jul-Aug	Lav,Wht	10"-20"	PM-PWM	Su	WS(30-60) or Fr	
Ambrosia artemisiifolia	Common ragweed	Jul-Oct	Gre	1'-3'	PD-PW	Su	None	Annual Weed
Ambrosia psilostachya	Western ragweed	Jul-Aug	Gre	1'-3'	PD-PDM	Su	None	SL-Per
Ambrosia trifida	Giant ragweed	Jul-Oct	Gre	6'	PD-PW	Su	None	Annual Weed
Amorpha canescens	Leadplant	Jun-Aug	Pur	20"-40"	PD-PWM	Ps,Su	WS(30),In,Sc	
Amphicarpa bracteata	Hog peanut	Aug-Sep	Wht,Lav	6"-60"	PDM-PW	Ps		Twining vine
Andropogon gerardi	Big bluestem	Aug-Sep		3'-8'	PD-PW	Su	DS	
Anemone canadensis	Meadow anemone	May-Jun	Wht	8"-32"	PM-PW	Su	WS(30-60)	Rh
Anemone cylindrica	Thimbleweed	Jun-Aug	Wht	1-3'	PD-PWM	Su,Ps,Sh	WS(90)-Es or Fa	
Anemone patens	Pasque flower	Apr	Lav	4"-16"	PD-PDM,C	Su	WS(90)-ES or Fa	
Anemone quinquefolia	Wood anemone	Apr-Jun	Wht	4"-8"	PDM-PW	Ps	WS (60-90)-Wa	
Angelica atropurpurea	Great angelica	May-Jun	Wht	2'-8'	PWM-PW,	Su,Ps	WS(90)-ES or Fa	
Antennaria spp.	Pussytoes	Apr-Jul	Wht	4"-16"	PD-PW	Su,Ps	WS(30-60)	
Apios americana	Ground nut	Jul-Aug	Brn-Pur	7'	PWM-PW	Sh,Ps		Rh, twining
Apocynum androsaemifolium	Spreading dogbane	Jun-Aug	Pnk	8"-24"	PD-PW	Ps,Su		
Apocynum cannibinum	Indian hemp	Jun-Sep	Wht/Gre	3'-5'	PDM-PW	Su		
Aquilegia canadensis	Wild columbine	May-Jun	Red/Yel	1'-3'	PD-PDM,C	Ps,Su	WS(30)	
Arabis lyrata	Sand cress	May-Jul	Wht	4"-16"	PD-PDM	Su,Ps	Fr-Lt	Biennial/SL-Per
Arenaria lateriflora	Wood sandwort	May-Jul	Wht	4"-12"	PWM	Ps,Sh	WS(30-60) or Fr	Rh
Arenaria stricta	Stiff sandwort	Jun-Sep	Wht	4"-16"	PD	Su	WS(30-60) or Fr	Annual/SL-Per
Artemesia caudata	Beach wormwood	Jul-Oct	Gre	1'-4'	PDM-PM	Su,Ps		Biennial
Artemisia frigida	Prairie sagewort	Jul-Sep	Gre	4"-16"	PD-PDM	Su		
Artemisia ludoviciana	White sage	Jul-Sep	Gre/Wht	1'-3'	PDM-PWM	Su		Rh
Artemisia serrata	Saw-toothed sagebrush	Aug-Oct	Gre	3'-6'	PWM	Su,Ps		Rh
Asclepias amplexicaulis	Blunt-leaved milkweed	Jun-Aug	Wht/Pnk	1'-3'	PDM-PWM	Su,Ps	WS(30-60)	
Asclepias hirtella	Tall Green milkweed	Jun-Aug	Gre	16"-40"	PDM,PM-P	Su	WS(30-60)	
Asclepias incarnata	Swamp milkweed	Jul-Aug	Red/Wht	1'-4'	PWM-PW	Su	WS(30-60)	
Asclepias lanuginosa*	Wooly milkweed	May-Jun	Pur	6"-12'	PD-PDM	Su,Ps		
Asclepias ovalifolia	Oval milkweed	Jun-Jul	Gre/Wht	8"-24"	PDM-PWM	Su,Ps		
Asclepias purpurascens*	Purple milkweed	Jun-Jul	Pur	2'-3'	PM-PWM	Ps,Su		

WISCONSIN PRAIRIE SPECIES LIST

Scientific Name	Common Name	Bloom	Color	Height	Habitat	Light	Germination Tmt	Comments
Campanula aparinoides	Marsh bell flower	Jun-Aug	Blu/Wht	12"-40"	PWM-PW	Su		Rh
Campanula rotundifolia	Harebell	Jun-Sep	Blu	4"-20"	PD-PDM	Ps,Su	WS(30-60)-Lt	
Carex bicknellii	Bicknell's sedge			20"-40"	PM-PW	Su		
Carex muhlenbergii	Sand sedge			8"-40"	PDM	Su		
Carex pensylvanica	Pennsylvania sedge			8"-16"	PDM-PW	Sh,Ps,Su		Rh
Cassia fasciculata	Partridge pea	Jul-Sep	Yel	4"-16"	PDM-PM	Su	DS or WS(30),In	Annual
Castilleja coccinea	Indian paintbrush	May-Aug	Red-Yel	5"-24"	PM-PW	Su		Annual
Castilleja sessiliflora	Downy paintbrush	May-Jul	Yel/Wht	5"-12"	PD-PDM,C	Su		
Ceanothus americanus	New jersey tea	Jun-Aug	Wht	1'-3'	PDM-PWM	Su,Ps	H20+WS(90)	Shrub
Ceanothus ovatus	Prairie redroot	May-Jun	Wht	1'-3'	PDM	Su	H2O+WS(90)	Shrub
Chelone glabra	Turtlehead	Jul-Sep	Crm	2'-3'	PW	Su,Ps,Sh	WS(120) or Fa	
Chrysopsis villosa	Golden aster	Jul-Oct	Yel	8"-40"	PD	Su		
Cicuta maculata	Water hemlock	Jun-Aug	Wht	2'-7'	PWM-PW	Su	WS(120) or Fa	
Cirsium discolor	Field thistle	Jul-Oct	Pur-Lav	3'-7'	PDM-PW	Su		SL-Per
Cirsium hillii*	Prairie thistle	Jun-Aug	Pur	1'-3'	PDM	Su		
Cirsium muticum	Swamp thistle	Jul-Oct	Pur	2'-7'	PWM-PW	Su,Ps,Sh		Biennial
Comandra umbellata	False toadflax	May-Jul	Wht	4"-12"	PD-PW	Su,Ps		Rh, parasitic
Convolvulus sepium	Hedge bindweed	Jun-Sep	Pnk/Wht	-10'	PD-PW	Su,Ps		Twining vine, weedy
Convolvulus spithameus	Low bindweed	May-Jul	Wht/Pnk	3"-20"	PDM	Su,Ps		Twining vine, weedy
Coreopsis palmata	Stiff coreopsis	Jun-Jul	Yel	20"-36"	PD-PWM	Su,Ps	WS(30-60)	Rh
Cyperus lupulinus	Flat sedge				PDM			
Cyperus schweinitzii	Flat sedge			8"-32"	PDM	Su,Ps		Rh
Cypripdeium calceolus	Yellow lady's slipper	May-Jul	Yel	8"-32"	PM-PWM	Sh,Ps	Difficult	Orchid
Cypripedium candidum*	White lady's slipper	May-Jun	Wht	6"-16"	PWM-PW,	Su,Ps	Difficult	Orchid
Delphinium virescens	Prairie larkspur	Jun-Jul	Wht	16"-48"	PDM	Su	WS(30-60) or Fa	
Desmodium canadense	Showy tick-trefoil	Jul-Aug	Pur	3'-6'	PDM-PW	Su,Ps	WS(30-60),Sc,In	
Desmodium illinoense	Illinois tick-trefoil	Jul-Aug	Pur	3'-6'	PD-PWM	Su	WS(30-60),Sc,In	
Dodecatheon meadia	Shootingstar	May-Jun	Wht/Lav	8"-24"	PDM-PW	Ps-Su	WS(60)-ES or Fa	
Draba reptans	Common whitlow-grass	Apr-May	Wht	2"-8"	PDM	Su	Fr-Lt	Annual
Echinacea pallida*	Pale purple coneflower	May-Aug	Lav	24"-40"	PDM-PM	Su	WS(30-60)	
Elymus canadensis	Canada wild rye			3'-6'	PD-PWM	Su,Ps	DS	
Elymus virginicus	Virginia wild rye			2'-4'	PWM	Ps,Su	DS	
Equisetum arvense	Field horsetail			6"-24"	PM-PW	Su	Spores	
Equisetum hyemale affine	Common scouring-rush			8"-60"	PD-PDM	Su	Spores	
Equisetum laevigatum	Smooth scouring-rush			12"-40"	PDM-PW	Su	Spores	

WISCONSIN PRAIRIE SPECIES LIST

Scientific Name	Common Name	Bloom	Color	Height	Habitat	Light	Germination Tmt	Comments
Heuchera richardsonii	Prairie alumroot	Jun-Jul	Grn	1'-3'	PDM-PW	Su,Ps	WS(90)-ES or Fa	
Hieracium canadense	Canada hawkweed	Jul-Oct	Yel	.5'-5'	PDM-PW	Su,Ps	WS(30-60)	
Hieracium longipilum	Hairy hawkweed	Jul-Aug	Yel	2'-5'	PD-PDM	Su	WS(30-60)	
Hierochloe odorata	Sweet grass			12"-20"	PWM-PW	Su,Ps	DS	
Houstonia caerulea	Bluets	Jun	Blu/Wht	2"-8"	PW	Su		
Houstonia longifolia	Long-leaved bluets	Jun-Aug	Wht	4"-10"	PDM	Su,Ps		
Hypericum canadense	Canadian st johnswort	Jul-Sep	Yel	4"-16"	PM	Su		Annual
Hypericum mutilum	Weak st johnswort	Jul-Sep	Yel	4"-32"	PM	Su		Annual
Hypoxis hirsuta	Yellow star grass	Apr-Jul	Yel	4"-12"	PDM-PW	Su,Ps	WS(30-60) or Fr	
Iris virginica shervei	Blue flag iris	May-Jul	Blu	1'-3'	PWM-PW	Su,Ps	WS(120) or Fa	
Koeleria cristata	June grass			1'-2'	PD-PM	Su,Ps	DS	
Krigia biflora	Cynthia	Apr-Jun	Yel	8"-32"	PM-PW	Su,Ps		
Krigia virginica	Dwarf dandelion	Apr-Jun	Yel	2"-16"	PDM	Su		
Kuhnia eupatorioides	False boneset	Aug-Oct	Crm	1'-4'	PD-PDM,C	Su,Ps	WS(30-60) or Fr	
Lactuca canadensis	Wild lettuce	Jul-Sep	Yel	1'-8'	PD-PWM	Su,Ps		Annual/Biennial
Lactuca ludoviciana	Western wild lettuce	Jul-Sep	Yel	1'-5'	PD-PM	Su,Ps		Biennial,SL-Per
Lathyrus palustris	Marsh vetchling	Jun-Jul	Lav	1'-4'	PWM-PW	Su,Ps	WS(30),Sc,In	Rh
Lathyrus venosus	Veiny pea	Jun-Jul	Lav	2'-3'	PDM-PW	Su,Ps,Sh	WS(30),Sc,In	Rh
Lechea intermedia	Intermediate pinweed	Jul-Sep	Red	8"-24"	PDM	Su,Ps		
Lechea tenuifolia	Slender-leaved pinweed	Jul-Sep	Red	3"-12"	PD-PM	Su,Ps		
Leptoloma cognatum	Fall witch grass			16"-28"	PDM	Su		
Lespedeza capitata	Round-headed bush clover	Jul-Sep	Wht	2'-4'	PD-PM	Su,Ps	WS(60),Sc,In	
Liatris aspera	Rough blazingstar	Aug-Oct	Mag	16"-48"	PD-PM	Su	WS(30-60)	
Liatris cylindracea	Dwarf blazingstar	Jul-Sep	Mag	8"-24"	PD-PDM	Su	WS(30-60)	
Liatris ligulistylis	Showy blazingstar	Aug-Sep	Pur	1'-4'	PM	Ps,Su	WS(30-60)	
Liatris punctata*	Dotted blazingstar	Jul-Sep	Ros	4"-32"	PD-PDM	Su	WS(30-60)	
Liatris pycnostachya	Prairie blazingstar	Jul-Sep	Mag	2'-5'	PM-PW	Su,Ps	WS(30-60)	
Liatris spicata	Marsh blazingstar	Jul-Sep	Mag	2'-6'	PM-PWM	Su	WS(30-60)	
Lilium michiganense	Turk's cap lily	Jul-Aug	Org	3'-6'	PM-PW	Ps,Su	WWS(90)/WS(90)	
Lilium philadelphicum	Wood lily	Jun-Aug	Org	1'-3'	PDM-PW	Ps,Su	WWS(90)/WS(90)	
Linum sulcatum	Grooved yellow flax	Jun-Jul	Yel	8"-32"	PD	Su,Ps	DS or WS(30)	Annual
Liparis lowselii	Green twayblade	Jun-Jul	Yel	4"-10"	PW	Sh,Ps	Difficult	Orchid
Lithospermum canescens	Hoary puccoon	Apr-Jun	Org	4"-18"	PD-PWM	Su,Ps	Fa orWS(120),Sc	
Lithospermum caroliniense	Hairy puccoon	May-Jul	Yel	6"-24"	PD-PDM	Su,Ps	Fa orWS(120),Sc	
Lithospermum incisum	Fringed puccoon	May-Jun	Yel	4"-20"	PD-PDM,C	Su		

WISCONSIN PRAIRIE SPECIES LIST

Scientific Name	Common Name	Bloom	Color	Height	Habitat	Light	Germination Tmt	Comments
Pedicularis canadensis	Wood betony	Apr-Jun	Yel	4"-16"	PD-PW	Ps,Su	WS(30)	Parasitic
Pedicularis lanceolata	Swamp betony	Aug-Sep	Yel	1'-3'	PWM-PW,	Ps,Su	WS(30)	Parasitic
Penstemon digitalis	Foxglove beardtongue	May-Jul	Wht	2'-5'	PDM-PM	Su,Ps	WS(60)-ES or Fa	
Penstemon gracilis	Slender beardtongue	Jun-Jul	Lav	8"-24"	PDM	Su,Ps	WS(60)-ES or Fa	
Penstemon grandiflorus	Beardtongue	May-Jun	Lav	12"-40"	PD-PDM	Su	WS(60)-ES or Fa	
Penstemon hirsutus	Hairy beardtongue	May-Jul	Lav	16-32"	PDM	Ps,Su	WS(60)-ES or Fa	
Petalostemum candidum	White prairie clover	Jun-Jul	Wht	1'-3'	PD-PWM	Su	WS(30),Sc,In	
Petalostemum purpureum	Purple prairie clover	Jun-Aug	Pur	1'-3'	PD-PWM	Su	WS(30),Sc,In	
Phlox glaberrima	Smooth phlox	Jun-Jul	Pnk	20"-48"	PDM	Ps,Su	WS(90) or Fr	
Phlox pilosa	Downy phlox	Apr-Jun	Pnk	6"-24"	PDM-PW	Su,Ps	WS(90) or Fr	
Physalis heterophylla	Clammy ground cherry	Jun-Sep	Yel/Brn	8"-36"	PD-PWM	Ps,Su		
Physalis subglabrata	Tall ground cherry	Jul-Aug	Yel	16"-32"	PD-PDM	Su,Ps		
Physalis virginiana	Lance-leaved ground cherry	Jul-Aug	Yel	1'-2'	PD-PWM	Su,Ps		
Physostegia virginiana	False dragonhead	Aug-Oct	Pnk	2'-3'	PD-PWM	Su, Ps	WS(60-90)	
Plantago rugelii	Red-stalked plantain	Jun-Aug	Grn	3"-12"	PDM	Su	WS(60-90)	Disturbed gnd, weedy
Platanthera flava*	Tubercled orchid	Jun-Sep	Crm	12"-28"	PWM-PW	Su, Ps	Difficult	
Platanthera leucophaea*	White fringed orchid	Jun-Jul	Wht	16"=40"	PWM-PW	Su	Difficult	
Polemonium reptans	Jacob's ladder	May-Jun	Blu	8"-16"	PWM-PW	Sh,Ps,Su	WS(60-90)-ES	
Polygala polygama	Purple milkwort	Jun-Aug	Ros	4"-10"	PD-PDM	Su	WS(30-60)	Biennial
Polygala sanguinea	Field milkwort	Jul-Sep	Ros	4"-16"	PDM-PWM	Su,Ps		
Polygala senega	Seneca snakeroot	May-Jul	Wht-Crm	4"-20"	PDM-PW,C	Ps,Su		
Polygala verticillata	Whorled milkwort	Jul-Oct	Crm-Grn	2"-16"	PDM	Su,Ps		Annual
Polygonatum canaliculatum	Smooth solomon's seal	May-Jul	Grn	1'-4'	PD-PWM	Ps,Su	WS/WWS/WS	Rh
Polygonum amphibium	Water knotweed	Jun-Aug	Pnk	1'-5'	PWM-PW	Su		
Polygonum tenue	Slender knotweed	Jun-Oct	Pnk	4"-16"	PD-PDM	Su		Annual
Polytaenia nuttallii*	Prairie parsley	May-Jun	Yel	20"-40"	PM-PWM	Su	WS(120) or Fa	
Potentilla arguta	Prairie cinquefoil	Jun-Jul	Yel	12"-40"	PD-PWM	Su,Ps	WS(30)-ES or Fa	Rh
Potentilla simplex	Common cinquefoil	Apr-Jun	Yel	2"-8"	PM-PWM	Su,Ps		Rh
Prenanthes alba	Lion's foot	Aug-Sep	Wht	1.5'-5'	PM-PWM	Sh,Ps	WS(30-60)	
Prenanthes aspera*	Rough white lettuce	Aug-Sep	Wht	2'-5'	PDM-PWM	Su		
Prenanthes crepidinea*	Great white lettuce	Aug-Sep	Crm	3'-7.5'	PWM	Sh,Ps,Su		
Prenanthes racemosa	Rattlesnake root	Sug-Sep	Lav	1'-5'	PDM-PW	Su	WS(120) or Fa	
Psoralea argophylla	Silvery scurfy pea	Jun-Aug	Blu	1'-2'	PM	Su		
Psoralea esculenta	Pomme-de-prairie	May-Jul	Blu	4"-16"	PD	Su	WS(60),In,Sc	
Pteridium aquilinum	Braken fern			2'-5'	PDM-PW	Ps,Su	Spores	Fern, Rh

WISCONSIN PRAIRIE SPECIES LIST

Scientific Name	Common Name	Bloom	Color	Height	Habitat	Light	Germination Tmt	Comments
Solidago juncea	Early goldenrod	Jul-Aug	Yel	1'-4'	PDM-PWM	Su	WS(60)-ES or Fa	
Solidago missouriensis	Missouri goldenrod	Jul-Aug	Yel	12"-40"	PD-PWM	Su,Ps	WS(60)-ES or Fa	Rh
Solidago nemoralis	Old-field goldenrod	Aug-Oct	Yel	4"-40"	PD-PWM	Su	WS(60)-ES or Fa	
Solidago ohiensis	Ohio goldenrod	Jul-Oct	Yel	16"-36"	PW	Su		
Solidago riddellii	Riddell's goldenrod	Aug-Oct	Yel	16"-40"	PWM-PW,	Su		
Solidago rigida	Stiff goldenrod	Jul-Oct	Yel	1'-5'	PD-PW	Su	WS(60)-ES or Fa	
Solidago speciosa	Showy goldenrod	Aug-Oct	Yel	1'-5'	PD-PWM	Su	WS(60)-ES or Fa	
Sorghastrum nutans	Indian grass			3'-7'	PD-PW	Su	DS	
Spartina pectinata	Prairie cordgrass			3'-7'	PM-PW	Su	DS	Rh
Spiranthes cernua	Nodding ladies' tresses	Aug-Sep	Wht	8"-40"	PM-PW	Ps,Su		
Sporobolus asper	Rough dropseed			1'-4'	PD-PM	Su		
Sporobolus cryptandrus	Sand dropseed			1'-3'	PD-PDM	Su	DS	
Sporobolus heterolepis	Prairie dropseed			16"-40"	PD-PWM	Su	DS-ES	
Sporobolus vaginiflorus	Sheathed rush grass				PD-PDM	Su		Annual
Stachys palustrus	Woundwort	Jun-Aug	Lav	12"-40"	PWM-PW	Su,Ps		Rh
Stipa spartea	Needle grass			2'-4'	PD-PWM	Su	Fr	
Taenidia integerrima	Yellow pimpernel	May-Jun	Yel	16"-32"	PM-PWM	Ps		
Tephrosia virginiana	Goat's rue	Jun-Jul	Pnk/Yel	8"-28"	PD-PM	Su,Ps,Sh	WS(30),Sc,In	
Teuricrium canadense	Germander	Jun-Aug	Pnk-Pur	12"-40"	PDM-PWM	Ps,Su		Rh
Thalictrum dasycarpum	Purple meadow rue	Jun-Jul	Crm	3'-4'	PM-PW	Su,Ps	WS(30-60)-ES	
Thaspium trifoliatum	Meadow parsnip	May-Jun	Pur	12"-32"	PM-PWM	Su,Ps	WS(120)-ES orFa	
Thelypteris palustrus	Marsh fern			14"-28"	PWM-PW	Sh,Ps,Su	Spores	Fern, Rh
Tofieldia glutinosa*	False asphodel	Jul	Wht	4"-8"	PW	Su		
Tradescantia ohiensis	Spiderwort	Jun-Jul	Blu	16"-40"	PD-PW	Su,Ps	WS(90)-ES or Fa	
Triodanis perfoliata	Venus looking glass	May-Aug	Blu	4"-40"	PDM-PD	Su,Ps		Annual
Triosteum perfoliatum	Late horse gentian	May-Jun	Grn-Yel	2'-4'	PDM, PWM	Sh,Ps		
Valeriana edulis ciliata	Valerian	May-Jun	Wht	1'-4'	PM-PW,Ca	Su	Fa	
Verbena hastata	Blue vervain	Jul-Oct	Blu	16"-40"	PWM	Su	WS(30)-Lt	SL-Per
Verbena stricta	Hoary vervain	Jul-Sep	Blu	8"-36"	PD-PDM	Su	DS or WS(30)	SL-Per
Vernonia fasciculata	Ironweed	Jul-Sep	Pur	2'-6'	PWM	Su,Ps	WS(30-60)	
Veronicastrum virginicum	Culver's root	Jun-Aug	Wht	3'-6'	PM-PW	Su,Ps	WS(30-60)-Lt	
Vicia americana	American vetch	Jun-Aug	Pur	to 3'	PM-PW	Ps,Su		Climbing vine
Viola cucullata	Hooded violet	Apr-Jul	Blu-Vlt	3"-6"	PM-PW	Su,Ps		Rh
Viola palmata	Palm-leaved violet	Apr-Jul	Vlt	6"-12"	PM	Su,Ps	WS(10-30) or Fa	Rh
Viola pedata	Bird's foot violet	Apr-Jul	Vlt	3"-6"	PD-PDM	Su,Ps	WS(10-30) or Fa	

Earth Partnership Program
UW-Madison Arboretum

PRAIRIE SPECIES SELECTION WORKSHEET

Common name							AP	MY	JU	JL	AU	SE	OC	Comments
Grasses														
Forbs														

Name: ______________________ School: ______________________ Date:

EARTH PARTNERSHIP PROGRAM
UW-MADISON ARBORETUM

PRAIRIE SPECIES MIX

SCHOOL:________________

PRAIRIE NAME:____________
AREA:____________(sq. ft)
GRASS/FORB RATIO:_______

Common name	Scientific Name	% of mix	Seed	Plants	Source	Cost
Grasses						
Forbs						

TOTAL SEED:____________
TOTAL PLANTS:____________
TOTAL COST:____________

SCHOOL PRAIRIES STUDY

Earth Partnership Program
UW-Madison Arboretum
Contact person: Becky Brown
608-262-9925

TO: Teachers in the Earth Partnership Program

This handout outlines the plans for a long-term study of the ecology of your school prairies, to be carried out jointly by you, your students, and Arboretum staff.

Goal of the program: To involve you and your students in the process of scientific discovery, and to help you find ways to use research as a teaching tool.

Goal of the research: To learn about the early stages of prairie restoration on school sites and to identify factors that affect the development of vegetation on these sites. To gather information that can be used in planning future restorations.

RESEARCH PROTOCOL

A. *Descriptive research*

1. Time frame: The study will be conducted over a 3-year period, with the possibility of extension (based on the 3-year results).

2. Species: Fifteen target species will be the focus of the research. These species were selected to include a range of plant families, growth forms and flowering times. The Arboretum will provide seed packets of these 15 species to participating schools for planting a 1000 sq ft area.

   Note: Other species of particular interest will be added to the design. For example, we would like to figure out what conditions are necessary for germination and growth of prairie dropseed grass, and we may ask you to plant a small area of dropseed to help us study this species. Details to follow.

3. Research plot: The research seed mix should be planted in a 1000 sq ft research plot. This area can be any shape, and can be a square or rectangle within a larger planting area. The research plot will be permanently marked with metal rods at the corners. We at the Arboretum will provide the metal rods and will help with setting up the plots.

8. Data analysis: The data from this project will be shared among schools, so your students will be able to compare their prairie with others and explore differences. When we have compiled enough information, Arboretum staff will assist with publishing the results.

B. *Experimental research*

We have much to learn about managing young prairie restorations, and a useful way to do this is to observe different management techniques side by side. A good example of this approach is the experimental area at the Arboretum where Molly Murray is studying four different site preparation treatments.

There are two post-planting management techniques that would be especially interesting to compare in your prairies:

(1) Mulching with marsh hay *vs* no mulching

(2) Cover crop *vs* no cover crop

We welcome your help with this portion of the research. To be involved, we would ask that you divide your 1000 sq ft research area into two parts (500 sq ft each), and apply one of the above treatments to one-half the area, leaving the other half as a control. The monitoring would be the same as outlined above for descriptive research.

School Prairies Study
Earth Partnership Program
UW-Madison Arboretum
1/95

School ______________________________

PLANTING RECORD

DATE	LOCATION OF PLANTING	SPECIES PLANTED	SEEDS OR PLANTS?	AMOUNT PLANTED	SEED SOURCE

SCHOOL PRAIRIES STUDY
CHECKLIST

Completed? (✓)	Date completed or planned?	
____	________	Schedule a site visit from Earth Partnership staff to see your proposed research site.
____	________	Measure out a research plot that is exactly 1000 sq. ft. in area.
____	________	Mark the corners of the research plot permanently with metal rods pounded all the way into the ground.
____	________	Collect a topsoil sample from your research plot and send to the Arboretum for analysis.
____	________	Make decisions about what additional species (seeds and/or plants) you will use to supplement the research seed mix. (The research mix supplies 40 seeds/sq.ft. of 15 target species).
____	________	Plant the research plot (spring or fall planting is fine).
____	________	Once a year for at least 3 years, do a plant inventory of the research plot, using the research protocol provided by the Earth Partnership Program.
____	________	Yearly plant inventory should be done between August 15-October 1. Let Earth Partnership staff know your plans for doing the inventory.

Who will do the inventory? ________________________________

When? ________________________________

How? ________________________________

REMINDERS:

*** Remember *not* to add any additional seeds or plants of the 15 target species.

*** Please let Earth Partnership staff know ahead of time when you plan to plant your research plot. Be sure to invite Becky out for planting day!

*** Call on us for help at any time!

We wish to participate in the School Prairies Study, and we agree to follow the procedures outlined above.

Teacher signatures: ____________________

____

School name: ____________________

Date: ____________________

SPROUTING *HYPOTHE*SEEDS

"Why can't science be more fun like the easy subjects?" (from G. Lake 1994)

"Science is pretty much taught as an assembly of facts." (D. Denton 1995)

INTRODUCTION: Science is much more than a collection of definitions and facts. It is a process; a way of thinking about the world and how it works; a set of problems to be solved. Science can be great fun when students become engaged in the excitement of scientific discovery.

How does this relate to the prairie restoration at your school? Let's face it --- restoration itself is really a big scientific experiment. Restorations at school sites provide convenient outdoor laboratories where students can observe, ask questions, and conduct experiments.

To involve students in the process of science, teachers must "be more like coaches than autocrats" (D. Denton 1995) and must be prepared to guide students' creative thinking. In this activity you are asked to delve into the scientific process by developing a question and designing an experiment to answer the question.

ACTIVITY: Your group's task is to come up with one question about **SEEDS**, and an experiment to answer the question. Use the seeds on the table as you wish to generate ideas. The sky's the limit! Be creative, be wild! There are no constraints, except that the experiment should be one that could be carried out in a school setting. Have fun!

DISCUSSION: What process did your group use to come up with a question? Did observation/discussion/prior knowledge play important parts? What factors did you consider in designing the experiment? In the classroom, how might you help students become familiar and comfortable with the process of scientific discovery?

RESOURCES:

Berger, Melvin. 1992. All About Seeds. Scholastic, Inc. New York.
Paperback for early elementary grades with a variety of do-it-yourself experiments.

Bottle Biology. 1993. Kendall/Hunt Publishing Company, Dubuque, Iowa.
An idea book for exploring the world through plastic bottles and other recyclables.

Greenler, R. 1994. A Prairie Activity Guide. UW-Madison Arboretum.
This guide is a part of the Prairie Restoration for Wisconsin Schools package. It contains many activities about prairies which are based on a discovery approach.

GrowLab: Activities for Growing Minds. 1990. National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.
Contains many activities and experiments on plants that can be conducted in the classroom. Activities for K-2, 3-5, and 6-8.

WHAT'S BUGGING YOU?

"Why can't science be more fun like the easy subjects?" (from G. Lake 1994)

"Science is pretty much taught as an assembly of facts." (D. Denton 1995)

INTRODUCTION: Science is much more than a collection of definitions and facts. It is a process; a way of thinking about the world and how it works; a set of problems to be solved. Science can be great fun when students become engaged in the excitement of scientific discovery.

How does this relate to the prairie restoration at your school? Let's face it --- restoration itself is really a big scientific experiment. Restorations at school sites provide convenient outdoor laboratories where students can observe, ask questions, and conduct experiments.

To involve students in the process of science, teachers must "be more like coaches than autocrats" (D. Denton 1995) and must be prepared to guide students' creative thinking. In this activity you are asked to delve into the scientific process by developing a question and designing an experiment to answer the question.

ACTIVITY: Your group's task is to come up with one question about **INSECTS**, and an experiment to answer the question. Walk in the prairie and observe insect activity to help generate ideas. The sky's the limit! Be creative, be wild! There are no constraints, except that the experiment should be one that could be carried out in a school setting. Have fun!

DISCUSSION: What process did your group use to come up with a question? Did observation/discussion/prior knowledge play important parts? What factors did you consider in designing the experiment? In the classroom, how might you help students become familiar and comfortable with the process of scientific discovery?

RESOURCES:

Bottle Biology. 1993. Kendall/Hunt Publishing Company, Dubuque, Iowa.
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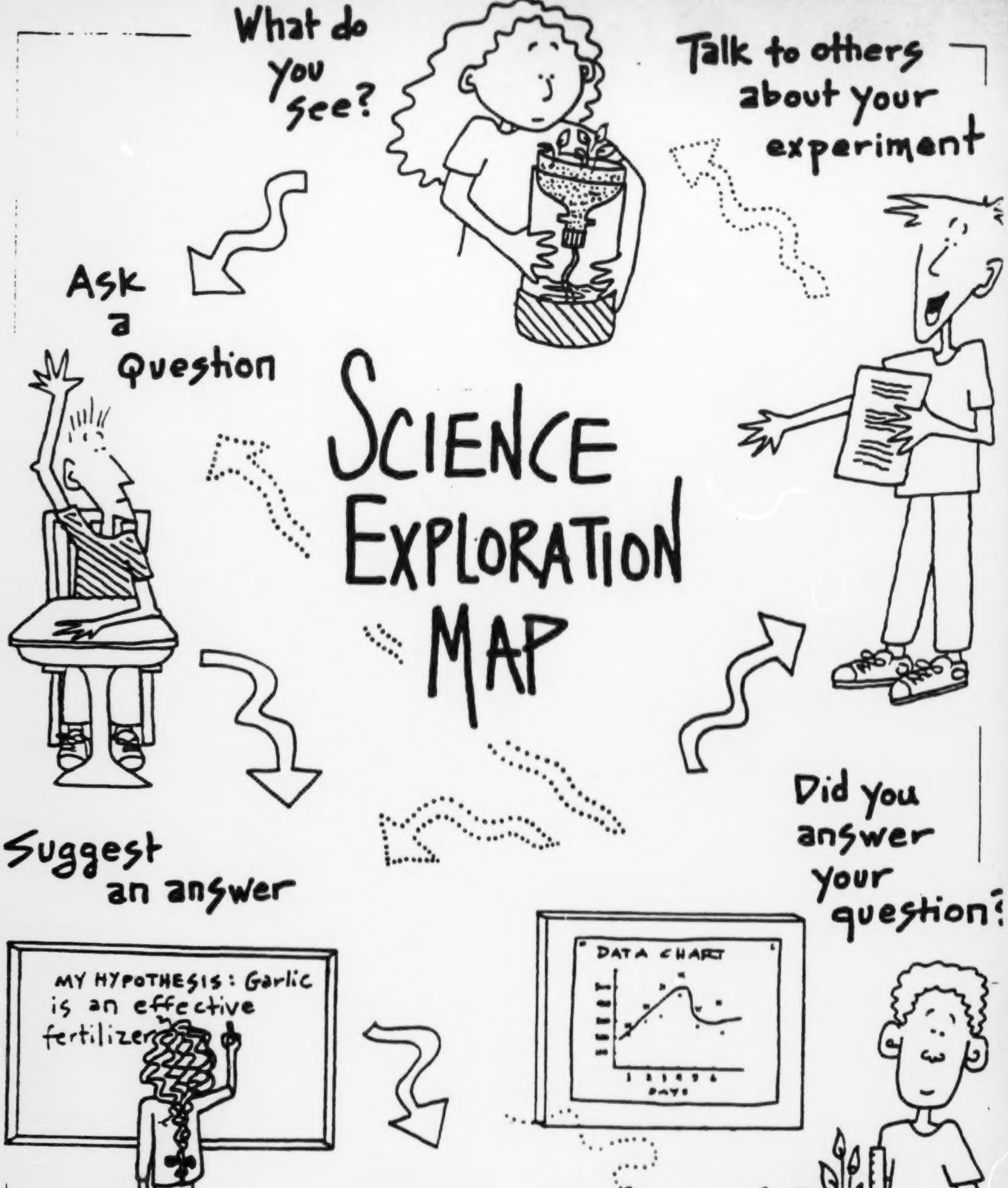
This guide is a part of the Prairie Restoration for Wisconsin Schools package. It contains many activities about prairies which are based on a discovery approach.

SCIENCE EXPLORATION MAP


What do you see?
Talk to others about your experiment
Ask a question
Suggest an answer
MY HYPOTHESIS: Garlic is an effective fertilizer
DATA CHART
DAYS
1 2 3 4 5 6
Did you answer your question?
Design an experiment
#1
#2
CONTROL

from. Bottle Biology, published by Kendall/Hunt Publishing Co, Dubuque, Iowa

The Flight of the Bumble Bee

Source: Robin Greenler
Subject: Music
Grade: K-12
Summary: Students analyze an insect's song and behavior and develop a musical composition to evoke it.

Activity Time: 20 minutes
Materials: Rimsky-Korsakov's The Flight of the Bumble Bee, other non-traditional versions optional. An interesting version is Yo Yo Ma and Bobby McFerrin's version on their compact disc entitled Hush (Sony Music Entertainment, 1992), which performs the piece as a cello/voice duet.
Season: early fall for field observations, any time for rest

Activity: Observe insects in the prairie. Pick one insect and imagine you are a composer trying to evoke that insect through music. What instrument(s) might you use? Would the players play low or high? fast or slow? loud or soft? smooth or choppy? melodious or dissonant? with periods of silence or music without pause? a single instrument or many? a long or short piece? Have students present a description of their insect and the musical piece they envisioned. Older students could develop a composition. Note: You do not have to imitate only the sound of the insect. Your musical choices can evoke the behavior, appearance, or activities of the insect.

Extension:
* Listen to Rimsky-Korsakov's Flight of the Bumble Bee. Discuss the musical choices he made. Have the students consider how they might do it differently.
* Listen to different interpretations of the Flight of the Bumble Bee to see how others have interpreted the music.
* Read the poem for two voices entitled Joyful Noise, by Paul Fleischman, Harper Row, 1988. Discuss how the voices become instruments in the poem.
* Students could make an instrument (out of recyclable/throwaway materials) that could mimic the insect of their choice.

ACTION PLAN

SITE ANALYSIS

- future plans
- accessibility
- soil analysis
- visibility
- foot traffic
- owners of land [city]
- design ["people places"]
- buffer zone
- weed ordinance
- tilling
- "tresspass" signs
- burn?
- fencing
- H_2O

STAFF

action committee formation/members

- inservice
- summer care
- inclusion of custodians
- continuance

RESOURCES

- TIME
- people - parents/comm
- ecology/garden club
- money
- Arboretum
- Prairie Nursery Catal

MONEY

- plants
- substitutes
- soil
- flat beds/pots
- fencing
- equipment
- fund raising
- signs
- prairie fund
- [illegible]

MAINTENANCE

- planting
- enrichment
- record keeping
- summer upkeep
- herbicides
- weeding
- burning?
- student particip.
- mowing

PLANT CHOICES

- seeds/plants
- burr oak
- aggressive
- "All-prairie" plants

REGULATIONS

- burn
- weed ordinance
- buffer zone
- city/school limits

MISC.

- field trips
- time line for Action Plan
- timeline for yearly goals
- after school club
- sign explaination
- bulletin board
- reading resources
- Benches

COMMUNICATION

- principal support
- parents (newsletter
- neighbors/communit
- w/established prairi @ other scho
- w/class members
- fall sign up for paren
- Open House messag
- PTO
- custodians
- school newspap
- research repo

Prairie plants that Attract Butterflies, Moths, Caterpillers and Birds

Common Name	Latin Name	Bird seed	Butterfly Nectar	Larval Food	Moth Nectar	Humming-bird Nectar	# Butterfly Species	Caterpillers	Butterflies
Yarrow	Achilea millifolium		•						Coppers, Metalmarks
Onions	Allium spp.		•						
Leadplant	Amorpha canescens		•	•				Dogface,Silverspotted skipper	Blues
Dogbane	Apocynum spp.		•				43		
Columbine	Aquilegia canadensis					•			
Milkweeds	Asclepias spp.		•	•			42	Monarch	Monarch, Queen, Hairstreak
Asters	Aster spp.		•	•			19	Pearl crescent.	Whites, Sulphers, Crescents, and Monarch
Poppy mallow	Callirhoe triangulata			•				Hairsteak	and Monarch
Tall Bellflower	Campanula americana		•						
Sedges	Carex spp.			•				Wood Nymph, Satyr, Skippers	
New Jersey tea	Ceanothus americanus		•		•	•	13		
Turtlehead	Chelone glabra		•	•				Baltimore,Buckeye	
Prairie thistle	Cirsium hillii						18	Painted lady	
Swamp thistle	Cirsium muticum	•	•				18	Painted lady	
Coreopsis	Coreopsis spp.	•	•						
Pale purple coneflower	Echinacea pallida	•	•					Fritillaries	
Puple coneflower	Echinacea purpurea	•	•						
Joe Pye-weed	Eupatorium maculatum		•				9		
Boneset	Eupatorium perfoliatum	•	•						
Wild strawberry	Fragaria virginiana	•	•						
Sneezeweed	Helenium autumnale		•					Dainty sulphur	
Showy sunflower	Helianthus laetiflorus		•						
Western sunflower	Helianthus occidentalis								
Oxeye sunflower	Heliopsis helianthoides								
Alumroot	Heuchera richardsonii				•	•			
Bush clover	Lespedeza capitata								Blues
Blazing stars	Liatris spp.	•	•		•				
Turk's cap lily	Lilium michiganense				•				
Cardinal flower	Lobelia cardinalis				•	•			
Lupine	Lupinus perennis		•	•				Carner blue, other Blues	

Prairie plants that Attract Butterflies, Moths, Caterpillers and Birds

Common Name	Latin Name	Bird seed	Butterfly Nectar	Larvel Food	Moth Nectar	Humming-bird Nectar	# Butterfly Species	Caterpillers	Butterflies
Bee balm	Monarda fistulosa		•		•				Hairstreaks
Glade Mallow	Napaea dioica			•				Hairsteaks	
Evening primrose	Oenothera biennis	•			•				
Foxglove beardtongue	Penstemon digitalis	•		•					
Large-flowered beard.	Penstemon gradiflorus	•		•					
White prairie clover	Petalostemum candidum		•						Blues, Dogface
Purple prairie clover	Petalostemum purpureum		•						Blues, Dogface
Prairie phlox	Phlox pilosa	•	•		•				
Cinquefoil	Potentilla spp.	•	•						Blues
Mountain mint	Pycnanthemum virginianum		•						Hairstreaks, Karner Blue
Yellow coneflower	Ratibida pinnata		•						
Rose	Rosa spp.	•	•						
Black-eyed Susan	Rudbeckia hirta		•	•					Crescents,Fritillaries
Little bluestem	Schizachyrium scoparium			•					
Rosinweed	Silphium integrifolium	•	•						
Compass plant	Silphium lacinatum	•	•						
Cupplant	Silphium perfoliatum	•	•						
Prairie dock	Silphium terebinthinaceum	•	•						
Goldenrods	Solidago spp.	•	•				18		Sulphers, Monarch
Spiderwort	Tradescantia ohiensis		•						
parsley family	Umbelliferae			•				Swallowtails	
Blue vervain	Verbena hastada		•				9		
Hoary vervain	Verbena stricta		•				9		
Ironweed	Veronica fasciculata		•				9		
Violets	Viola spp.			•					
Golden Alexanders	Zizia spp.			•				Swallowtails	
Prairie grasses	*(nesting and cover)*	•	•	•				Wood nymph, Satyr, Skipper	Satyrs, Skippers

UW-Madison Arboretum. Earth Partnership Program - 1995

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Maintaining —the Garden—

The biggest challenge is controlling weeds during the first two or three years. Prairie plants spend the first years of their life rooting while Eurasian weed species put all their energy above the ground, crowding out prairie seedlings.

Weed control can be accomplished through a variety of means such as herbicides, mulching or hand weeding. Planting a groundcover crop like oats or annual rye the first summer will take up space so weeds cannot crowd out prairie plants. Since they only live one year, they will allow prairie plants room to expand the second year.

Mowing and raking every spring also helps control weeds and promote growth. You should mow in late June with the blade set about 5-8 inches high. This will cut back early growing annual weeds but not affect slower-growing prairie plants.

By the third year, there is little for the prairie gardener to do but enjoy his colorful landscape! They require no covering, no pruning, no spraying, little if any fertilizing and no irrigating—saving prairie gardeners hundreds of dollars in maintenance costs and hours of labor.

Selected —References—

The Prairie Garden: 70 Native Plants You Can Grow in Town or Country by J. Robert Smith and Beatrice S. Smith, the University of Wisconsin Press, 1980.

Nursery Sources: Native Plants and Seeds available from New England Wildflower Society, Garden in the Woods, Hemenway Road, Dept. FG, Framingham, MA 01701

Sources of Prairie, Woodland and Wetland Plants —and Seeds—

Clyde Robin Seed Co.
P.O. Box 2366
Castro Valley, CA 94546

Lafayette Home Nursery
RR Box 1A
Lafayette, IL 61449

Little Valley Farm
Rt. 3
Spring Green, WI 53588

Midwest Wildflowers
Box 64
Rockton, IL 61072

Niche Gardens
1111 Dawson Road
Dept. O
Chapel Hill, NC 27516

Orchid Gardens
2232 - 139th Ave. NE
Andover, MN 55304

Prairie Moon Nursery
Rt. 3, Box 163
Winona, MN 55987

Prairie Nursery
Dept. FGA
P.O. Box 365
Westfield, WI 53964

Prairie Restorations, Inc.
P.O. Box 327
Princeton, MN 55371

Prairie Ridge Nursery
Rt. 2, Overland Road
Mount Horeb, WI 53572

Wildlife Nurseries
Box 2724
Oshkosh, WI 54903

Wildseed, Inc.
1101 Campo-Rosa Road
P.O. Box 308
Eagle Lake, TX 77434

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(614) 265-6994 (TDD)

George V. Voinovich
Governor

Donald C. Anderson
Director

Making a Prairie Garden

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Making a Prairie Garden

Easy-to-grow prairie plants are among nature's most spectacular flowers, producing waist-high blooms of brilliant yellow, flaming crimson and soft lavender. Because of their extensive root systems, prairie plants can be the answer to problem garden spots, and once established they require little maintenance.

Small patches of prairie grow throughout much of Ohio. They are relicts of a time 4,000-6,000 years ago when a sustained warm, dry period caused the expansion of drought-resistant western plants eastward through Ohio to western Pennsylvania.

When the rain and cooler summers eventually returned, the eastern edge of the prairie again gave way to forest except for pockets of land where erosion, shallow dry soils or prolonged seasonal flooding prevented tree seedlings from developing. Today, because of agricultural expansion, only a few scattered prairie remnants survive.

Choosing the Site

The first step in creating a prairie landscape is to choose the site. Except for needing full sunlight, prairie plants adapt to most conditions.

Prairie plants grow in a diversity of soils, from clay to sand, and tolerate a wide range of soil fertility and acidity. Prairie plants also grow in dry shallow soils or marshy soils that most plants cannot tolerate.

Prairies are divided into three types: dry, mesic or moderately moist and wet. Mesic and dry prairie plants prefer loose soil with good draining while wet species grow in poorly drained areas where water stands after a heavy rain. Using a wide range of prairie species can help disguise problem areas such as a boggy hollow or a gravel hill and blend them into surrounding areas.

Planning

Once the site is selected, you may want to draw a planting plan. The following tips can help you design an attractive and healthy garden:

- Prairies are grasslands, but check local weed control ordinances before planting prairie grasses. Instead, you may prefer to concentrate on prairie wildflowers.
- Use native Ohio species whenever possible.
- Match plants to your soil—dry, mesic or wet.
- Fit the size of the plants to the size of your area. Keep tall plants to the edges.
- Planting in curves instead of rows will give you a more natural look.
- Allow one species to dominate, then blend into another.
- Try for continuous color throughout the growing season.
- In a large prairie garden, you may want to make paths to walk along.
- You can turn your prairie garden into a wildlife oasis by selecting plants that are attractive to butterflies, birds and other wildlife.

Nurseries that sell prairie seeds or books about prairie flowers can help you select the species best suited to your needs.

Collecting Seeds

The next step is to obtain seed for your prairie garden. The best seed source is the many prairie remnants that grow along highways, railroads, fencerows and in abandoned cemeteries throughout the state.

Many prairie plants are rare or endangered and protected by law when growing on public land. Therefore, *seeds cannot be collected from state nature preserves or wildlife areas.* Always get permission from landowners when collecting on private land.

Digging a mature plant is not a good idea because its deep roots make it almost impossible to move. Also leave enough seeds at the collection site for it to propagate itself.

Scout prairie areas during the peak blooming season, late July through August, to find which seeds you want to collect. Then draw a map or mark the flowers with a stake or tie.

Seeds should be collected when they become ripe in the fall.

Preparing and Planting Seeds

Once collected, seeds should be spread on a screen to dry to prevent mold. Surrounding plant material should be removed.

Because the seeds have to go through a cold spell to trigger germination, they have a better chance of growing if planted in the fall as soon as they become ripe. However, fall planting increases the toll taken by rodents, birds and insects during the winter, so plant more than needed.

If not planted when collected, the seeds need to be stored in a cool place until spring. During winter, you can use the trunk of your car or the crawl space of your house for storage. However, as soon as it starts to get warm, place them in the refrigerator. *Even one 80-degree day will break the germination, and seeds will have to go through another cold spell before growing.*

Hard dense seeds may need their seedcoat scratched before germinating. Shaking them in a small coffee can lined with rough sandpaper is a good way to do this.

Prairie seeds need light to sprout. Once the garden is plowed and cultivated, just scratch the surface then pack the seeds down by stepping on them.

INFORMATION ON PRAIRIE PLANTINGS

Indiana Department of Natural Resources
Division of Nature Preserves

The use of native plants in landscaping, wildlife plantings, reforestation, erosion control and other such uses is rapidly growing. A part of this interest and growth involves the use of prairie vegetation. Indiana is on the eastern edge of North America's tallgrass prairie region. At the time it was settled by Europeans some 200 years ago, tallgrass prairie and related plant communities (such as savannas, barrens, glades and fens with floras made up largely of prairie species) covered large areas of Indiana. Prairie alone covered around 3 million acres, but it has nearly all been converted to agricultural, industrial and urban uses. Today, only a few scattered (and small!) remnants remain.

It is fitting that prairie vegetation be a part of the interest in planting native species in Indiana, and we certainly encourage it. Prairie grasses and wildflowers are attractive, drought resistant plants that can play an important role in flower gardens, prairie display areas, wildlife areas, large-scale prairie restorations and so on. Much patience is required since quick results are not to be expected. It often takes three years or more for a planting to really begin expressing itself. Also, purchasing prairie seeds and plants can be rather expensive, especially for forbs (wildflowers).

As a major landscape type, prairie was confined mostly to the northwestern corner of Indiana, and there are many prairie species whose Indiana ranges are strictly confined to that part of the state. Small prairies did occur here and there in other parts of Indiana, but they were usually smaller inclusions within a forested landscape. Many did not contain the full complement of species found in the "Grand Prairie" of northwestern Indiana.

We strongly encourage people to make their prairie plantings as locally correct as possible. This is less important in the prairie garden than it is for larger "landscape" plantings from which plants are more likely to disperse. Admittedly, most prairie plants do not spread readily, but when they do, "out-of-place" plants are especially confusing to botanists and biogeographers.

Nurseries that specialize in prairie vegetation often supply seed mixes containing twenty or thirty "standard" species. These mixes would probably be locally correct statewide for prairie states like Illinois or Iowa, but not for all of Indiana. They would be fine for northwestern Indiana, but contain species which are not native to east-central or southeastern Indiana, for example. Since most out-of-state nurseries are not familiar with the distribution of specific prairie plants within Indiana, they are probably unaware of what constitutes a locally correct seed mix for your area of Indiana. Indiana suppliers should be more helpful in this regard.

With a little effort, you can do it yourself by doing some cross-referencing between two good source books: Prairie Propagation Handbook and Flora of Indiana. The Prairie Propagation Handbook by Harold Rock is one of the best guides available regarding the planting of prairie vegetation, and it is highly recommended. For the latest information on price and ordering information, contact:

Wehr Nature Center
9701 West College Ave.
Franklin, WI 53132
ph. (414) 425-8550

Flora of Indiana (1940) by Charles C. Deam is out of print, but available in many libraries. It can sometimes be found in used bookstores or on mail order natural history used book lists, but it is very expensive ($60-$100 a copy). A more recent reprinted edition of that book is out of print now, also. Deam's Flora is a well-known, authoritative treatment of the plants of Indiana including county range maps. By finding a prairie plant species list for the proper soil moisture in Prairie Propagation Handbook, one can check Flora of Indiana to determine which species occur in your locality.

When buying prairie seeds and/or plants, keep in mind that western and southern ecotypes of species which occur in Indiana may be very different from our plants, and also, they may not be well adapted for survival here. Because of that, we encourage individuals to purchase ecotypes which originate in the more northeastern parts of the tallgrass prairie region such as Indiana, Illinois, Wisconsin, eastern Iowa, southeastern Minnesota, or eastern Missouri.

We recommend avoiding materials whose genetic origins are from Texas, Oklahoma, Kansas, Nebraska or the Dakotas. In addition to the genetic differences in those species which are native to Indiana, seed mixes from these states often include plants which are not native here. Buffalo grass (Buchloe dactyloides) and blanket flower (Gaillardia pulchella) are a couple such examples.

Indiana nurseries supplying prairie plants whose genetic origins are mostly from within Indiana are of very recent establishment. Although these nurseries do not yet have the quantities of seed and root material that older out-of-state suppliers can supply, you should consider them as you make your plans. The known such nurseries include:

J.F. New & Associates
P.O. Box 243
Walkerton, IN 46574
ph. (219) 586-3400

Spence Nursery, Inc.
P.O. Box 546
Muncie, IN 47308
ph. (317) 286-7154

The following is a list of other midwestern sources. Many of these have great catalogs with excellent information on soil preparation, planting tips, and so on.

Country Road Greenhouses, Inc.
19561 East Twombly
Rochelle, IL 61068
ph. (815) 384-3311

Prairie Ridge Nursery
9738 Overland Road
Mt. Horeb, WI 53572
ph. (608) 437-5245

Bluestem Prairie Nursery
R.R. 2, Box 106-A
Hillsboro, IL 62049
ph. (217) 532-6344

Prairie Nursery
P.O. Box 306
Westfield, WI 53964
ph. (608) 296-3679

Peter Schramm
Prairie Restorations
766 Bateman Street
Galesburg, IL 61401
ph. (309) 343-2608

Prairie Moon Nursery
R.R. 3, Box 163
Winona, MN 55987
ph. (507) 452-1362

Genesis Nursery, Inc.
R.R.1, Box 32
Walnut, IL 61376
ph. (815) 379-9060

Shooting Star Nursery
444 Bates Road
Frankfort, KY 40601
ph. (502) 223-1679

Ion Exchange
1878 Old Mission Drive
Harpers Ferry, IA 52146
ph. (319) 535-72

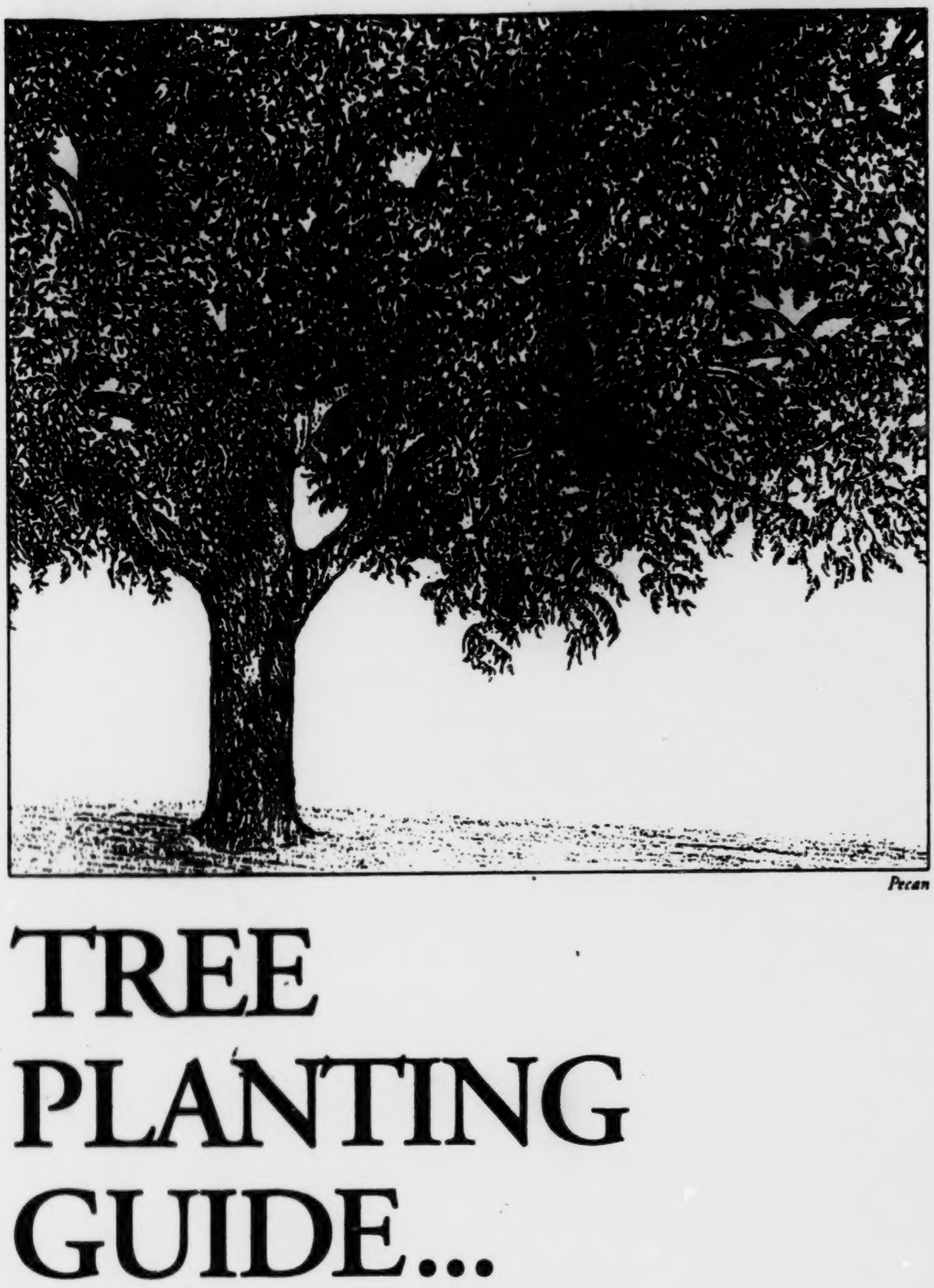
LaFayette Home Nursery
LaFayette, IL 61449
ph. (309) 995-3311

For photos, descriptions and various ecological information on prairie plants, you may want to consider the following two books which are available in many book stores:

Wildflowers of the Tallgrass Prairie: The Upper Midwest by Sylvan T. Runkel and Dean M. Roosa. Iowa State University Press, 1989.

Tallgrass Prairie Wildflowers by Doug Ladd. Falcon Press, 1995.

Revised 7/96



Pecan

TREE PLANTING GUIDE...

For El Paso, Juarez, West Texas and Southern New Mexico

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(MISSOURI)

Native Plants for Landscaping

David Besenger

Landscaping with wildflowers adds beauty and, just as importantly, takes away some of the time, effort, chemicals and water you usually put into gardening. Here's a list of the wildflowers useful in landscaping and the procedures involved in their establishment.

Information on site preparation, establishment and maintenance is geared for naturalized prairie plantings, though it's useful to home gardeners as well. The species listed are adapted to growing in full sun. The list is certainly not comprehensive, but does include some of the more popular wildflowers and those commercially available.

This is not a complete guide to wildflower establishment; you'll find more specific information in the references listed at the end, or by contacting a wildflower nursery.

WILDFLOWERS

The following species will provide color from May through October. All are suitable for plantings in full sun.

COMMON NAME	SCIENTIFIC NAME	HEIGHT	COLOR	BLOOMING PERIOD
Wild Onion	Allium mutabile	1-2'	pale pink	May-June
Wild Onion	Allium stellatum	1-2'	pale pink	Sept-October
Lead Plant	Amorpha canescens	18"-3'	lavender	mid-June to mid-July
Butterfly Weed	Asclepias tuberosa	1-2'	red-orange	mid-June to mid-August
Aster	Aster spp.	2-4'	white, blue, purple	August-October
Cream Wild Indigo	Baptisia leucophaea	1-2'	cream	May
Blue Wild Indigo	B. australis	2-3'	blue	May
Tickseed Coreopsis	Coreopsis spp.	1-3'	yellow	late May to August
Larkspur	Delphinium virescens	1-3'	white	June-July
Shooting Star	Dodecatheon meadia	1-2'	pink or white	May
Pale Purple Coneflower	Echinacea pallida	2-3'	lavender	June
Yellow Coneflower	E. paradoxa	2-3'	yellow	June
Western Sunflower	Helianthus occidentalis	1-3'	yellow	August-October
Blazing Star	Liatris squarrosa or cylindracea	1-3'	purple	July-August
Bergamot	Monarda fistulosa	2-3'	lavender	July
Missouri Evening Primrose	Oenothera macrocarpa	less than 12"	yellow	June
Beardtongue	Penstemon spp.	1-2'	white, purple	April-June
White Prairie Clover	Petalostemon candidum	1-3'	white	July
Purple Prairie Clover	P. purpureum	1-3'	purple	July
Prairie Phlox	Phlox pilosa	1-2'	rose-purple	May
Wild Sweet William	Phlox spp.	1-2'	rose-purple	May
Blackeyed Susan	Rudbeckia hirta	1-3'	yellow	June
Missouri Coneflower	R. missouriensis	1-2'	yellow	July
Blue-eyed Grass	Sisyrinchium campestre	8-10"	blue	May
Goldenrod	Solidago spp.	1-3'	gold	August-October
Goatsrue	Tephrosia virginiana	1-2'	creamy pink	June
Spiderwort	Tradescantia ohiensis	2-3'	blue	May-June
Rose Verbena	Verbena canadensis	18-24"	purple	April-November
Swamp Milkweed	Asclepias incarnata	2-4'	rose	June-July

COMMON NAME	SCIENTIFIC NAME	HEIGHT	COLOR	BLOOMING PERIOD
Rattlesnake Master	Eryngium yuccifolium	3-4′	green-white	July
Ashy Sunflower	Helianthus mollis	3-5′	yellow	August
Maximillian Sunflower	H. maximilliani	3-5′	yellow	September
Rough Blazing Star	Liatris aspera	4-6′	purple	September-October
Gayfeather	L. pychnostachya	3-6′	purple	July-August
Grayheaded Coneflower	Ratibida pinnata	3-5′	yellow	July-August
Compass Plant	Silphium laciniatum	4-8′	yellow	July-August
Rosin Weed	S. integrifolium	4-6′	yellow	July-August
Prairie Dock	S. terebinthinaceum	3-6′	yellow	July-September

GRASSES

COMMON NAME	SCIENTIFIC NAME	HEIGHT	LBS./ACRE (SUGGESTED SEEDING RATE)
Buffalo Grass	Buchloe dactyloides	6-8"	—
Little Bluestem	Andropogon scoparius	2-4′	—
Blue Gramma	Bouteloua gracilis	1-2′	—
Sideoats Gramma	Bouteloua curtipendula	1-3′	4.0
Prairie Dropseed	Sporobolus heterolepis	1-2′	1.0
Big Bluestem	Andropogon gerardii	3-8′	4.0
Switchgrass	Panicum virgatum	3-5′	1.0
Indian Grass	Sorghastrum nutans	3-6′	1.0

Seeds or Transplants? Many of the listed species can be grown successfully in a planting from seed. Others are slow growers and do better when transplants are used. Whether to use seeds or transplants depends on a number of factors including the size of the area to be planted, cost and desired blooming. Generally most species bloom from seed the second or third year, so if you want quick results, use transplants. Transplants are generally practical in smaller areas (less than 2500 square feet). Initial cost is also a factor. (Wildflower seeds can range from $35 to $200 per pound.) Generally, seeds are better for larger, naturalized prairie plantings while transplants are suited for smaller, landscaped plantings and the home gardener.

Site Preparation: Proper site preparation will reduce weeds and increase chances of good seed germination, as well as facilitate planting. Site preparation should begin in the fall prior to a spring planting. For larger areas, existing vegetation can be removed by fall plowing (if erosion is not a problem) and spring discing every two weeks until planting. If the area is subject to erosion or if fescue is present, vegetation can be controlled by two applications of a herbicide either once in the fall and again in the spring, or two weeks apart in the spring, followed by discing beginning two weeks after the last application and continuing every two weeks until planting. The application rate for glyphosate is 1 1/2 pints to 1 quart in 10 gallons of water plus surfactant per acre.

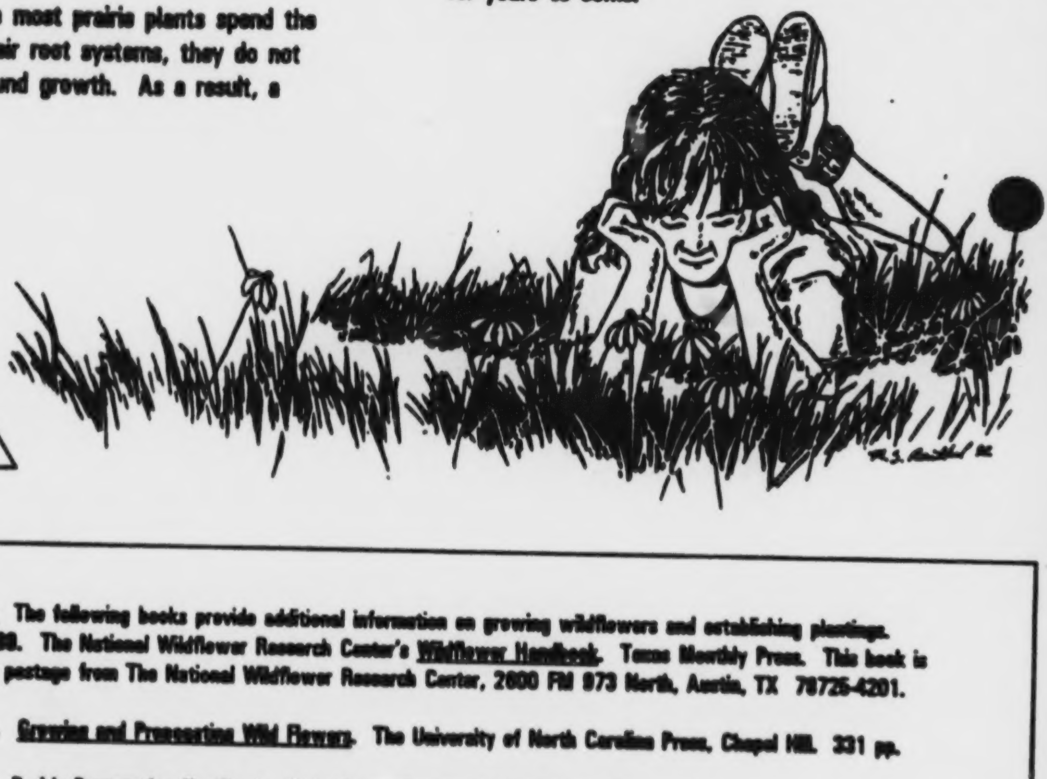
Seeding Rates (for naturalized plantings): Wildflowers show up best in a mixture including native warm season grasses. An approximate ratio is 60% grasses to 40% wildflowers at a rate totaling 10 to 15 pounds per acre. Seeds can be mixed with sand to help in broadcasting. After sowing, seeds should be covered by raking and rolling to firm the soil. For areas less than 2 acres in size, seeds can be hand-broadcast. Follow a design plan and put the seeds, by species, where you want them. Areas greater than 2 acres are impractical for hand-broadcasting and should be mechanically seeded.

Transplanting: Transplanting of bare root seedlings should be done in the late fall or early spring while the plants are dormant. Till the soil deep enough so digging is easy. Dig individual holes deep enough so the terminal buds can be placed about an inch below the soil surface without bending or curling the roots. Potted plants can be transplanted anytime.

Weed Control: Because most prairie plants spend the first year establishing their root systems, they do not produce much above ground growth. As a result, a naturalized planting often resembles a weed patch the first year. In a large planting, weeds should be controlled by mowing to 6 to 8 inches two or three times during the summer. On small areas, hand pulling may be neces[illegible] (But be sure you know which are the weeds!) Most [illegible] the weeds will probably be annuals.

Maintenance: A naturalized planting will begin to resemble a prairie by the second year. Mowing in late June may still be necessary to control annual weeds. Ideally, a prairie planting should be burned every three or four years beginning the third year. Burning should be done in the early spring (before April 15), and only after obtaining needed permits. Fall mowing (November) with spot applications of herbicide to invading woody plants can be done where burning is not feasible.

By the fourth year, a naturalized prairie planting should be well established and will pretty much take care of itself for years to come.



For Further Information: The following books provide additional information on growing wildflowers and establishing plantings.

Paulson, Annie, Ed. 1989. The National Wildflower Research Center's Wildflower Handbook. Texas Monthly Press. This book is available for $9.95 plus postage from The National Wildflower Research Center, 2600 FM 973 North, Austin, TX 78725-4201.

Phillips, Harry R. 1985. Growing and Propagating Wild Flowers. The University of North Carolina Press, Chapel Hill. 331 pp.

Rock, Harold W. 1977. Prairie Propagation Handbook. Wehr Nature Center. Whitnall Park, Wisc. 67 pp.

Smith, J. Robert with Beatrice S. Smith. 1980. The Prairie Garden. The University of Wisconsin Press, Madison. 219 pp.

Sullivan, Gene A. and Richard H. Daley. 1981. Directory to Resources on Wildflower Propagation. Prepared by the Missouri Botanical Garden for the National Council of State Garden Clubs, Inc., St. Louis. 331 pp.

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4B: Deserts (Aridlands)

Water Harvesting Traditions in the Desert Southwest

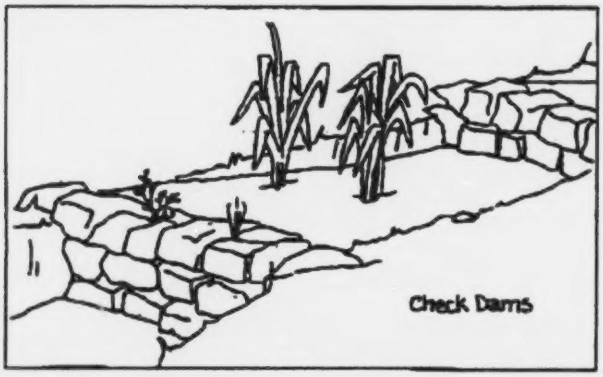
Water harvesting and conserving techniques were used by native Americans for centuries to produce abundant harvests in the deserts of the southwestern United States and northern Mexico. These systems hold vital lessons for modern inhabitants here and in arid and semiarid areas around the world.

By Joel Glanzberg
Illustrations by Roxanne Swentzell

Before the advent of modern irrigation technology, peoples of the American southwest relied upon an array of water harvesting and conserving techniques to grow their food. Not only are these techniques still appropriate, but their use, scale, and at times failures have much to teach us. Several of the systems used by the traditional people are described and illustrated below.

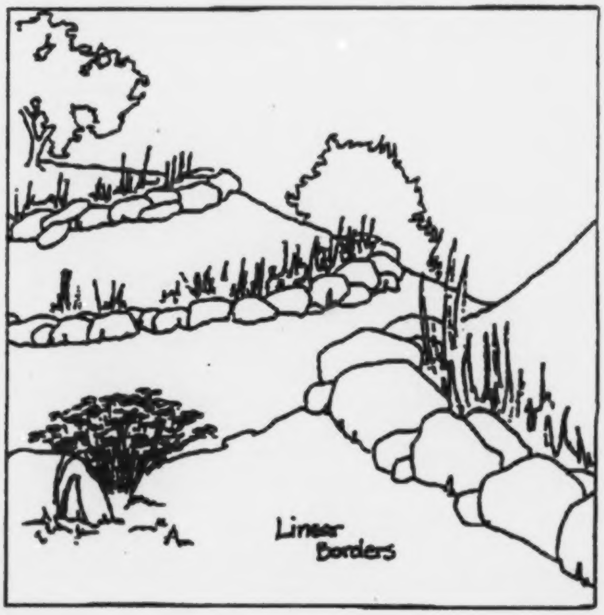
Check Dams

Check dams are built across drainages that flow only periodically. They are constructed of rock and can range in size from small to large. These rock dams catch soil and water, and were often built higher as more soil accumulated behind them. They provided an excellent way to fertilize soil and stabilize drainages, and were used for all kinds of crops. There are good examples in Colorado, Utah, and New Mexico at Mesa Verde and Hovenweep National Parks and numerous small dams in the upper Rio Grande and Chama drainages and throughout the Pajarito Plateau.



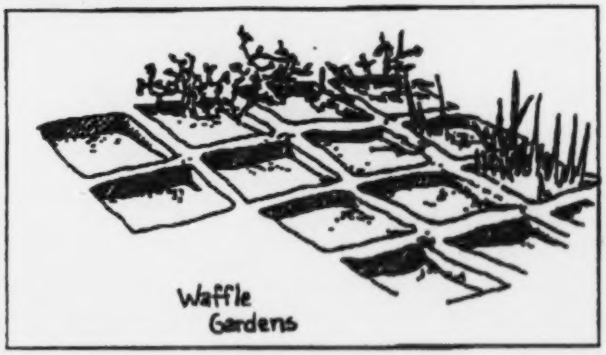
Terraces or Linear Borders

Terraces themselves were sometimes built, but check dams and low lines of stone across slopes of hills were more common. At Point of the Pines in Arizona, hilltop pueblos were surrounded by concentric rings of rocks gathered from the entire hillside and laid along contour lines across the slopes. Soil washing down the bare hillsides caught behind the stone walls, accumulating up to 16 inches deep. This loose soil would have been highly fertile and water absorbing.



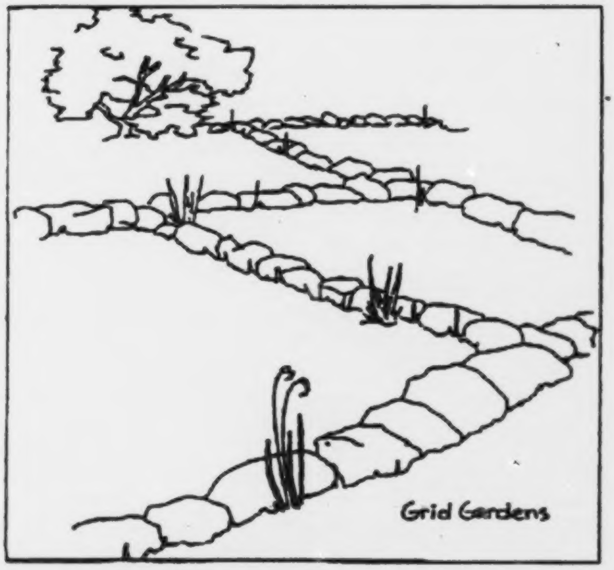
Waffle Gardens

Waffle gardens can be either sunken beds with ground-level berms, or ground-level beds surrounded by raised berms of earth. The bermed beds catch and hold rainwater as well as retain water brought by hand. Waffle beds were built on a very small scale for especially valuable crops. They are best known historically at Zuñi.



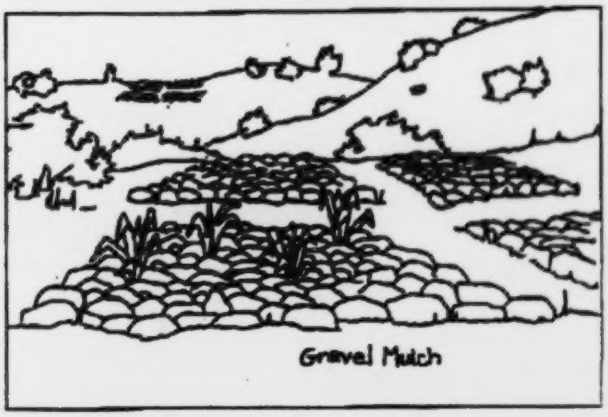
Grid Gardens

Grid gardens are similar to waffle gardens, but have walls made of stone rather than earth. They usually have much larger beds than waffle gardens. The walled beds help hold soil and were often placed to catch water runoff from moderate slopes. They were used extensively during prehistoric times throughout the upper Rio Grande, the Chama, and the Ojo Caliente drainages. They were probably not hand watered and it appears likely they were used to grow major crops such as corn and beans.



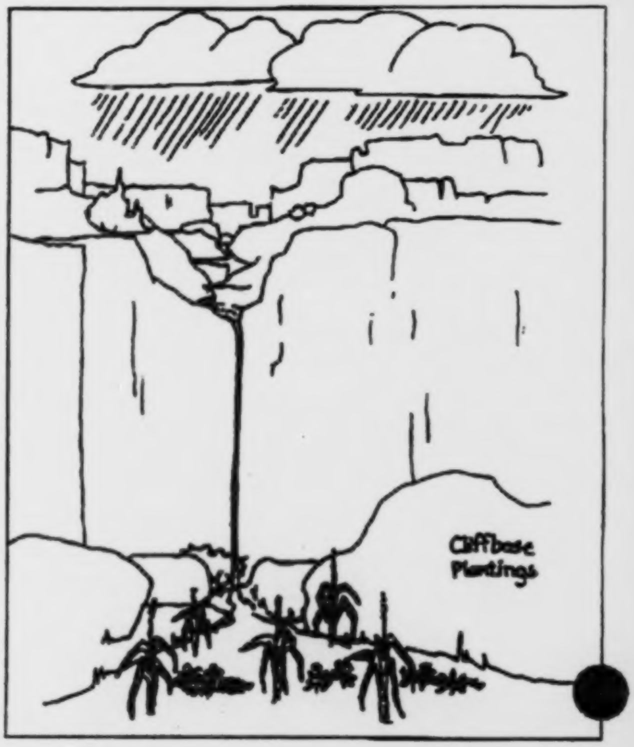
Gravel- and Rock-Mulched Fields

Mulch of any kind slows evaporation by sheltering the soil surface. The Anasazi clearly knew this. Throughout the upper Rio Grande and Chama Drainages, vast areas were mulched with gravel. Grid gardens were often covered with mulch. Gravel mulches not only conserve moisture, they also reduce wind and water erosion. Dark gravel mulches increase soil and air temperatures, reducing the threat of early and late frosts. At Wupatki in northern Arizona, the Sinagua people were able to grow food without supplemental water largely because the natural covering of cinders created by the eruption of Sunset Crater. This eruption, and the resultant layer of cinders which covered highly fertile, water-holding volcanic ash, was responsible for Anasazi, Hohokam, and Mogollon people moving into this area to live, creating the Sinagua culture around A.D. 1000.



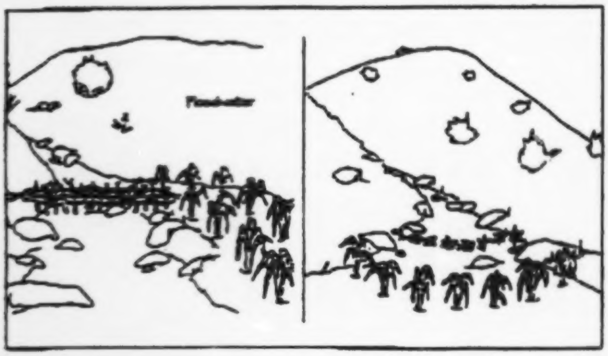
Cliffbase Plantings

Often the water-collecting surfaces of cliffs were used to provide water for crops. By planting where water would run off and be concentrated, available moisture and fertility could be increased. At Chaco Canyon this technique was used extensively. A complex irrigation system was developed using cliff runoff. Grid gardens, checkdams, and terraces were located in various places to catch this runoff.



Floodwater Farming

Often the fans of soil below arroyos or small canyons were planted to utilize the flood waters coming down these drainages. This is sometimes known as *akchin* farming and is still practiced by the O'odham and Hopi. In some cases, the field is sited beside the path of the arroyo. Brush weirs are then constructed across the bed of the arroyo to direct water out of the arroyo and onto the field. A destructive flood will blow out the weir, but will not destroy the field. Destruction of the field by a flood is a very real problem with *akchin* farming for fields located directly in the paths of arroyos.



Floodplain Farming

Soil located in or near a channel of flowing water is usually moist and fertile. For this reason, floodplain fields were situated along the margins of permanent or ephemeral streams, the low terraces of arroyos, or within the bottoms of arroyos. The principle is similar to the moisture and fertility enhancement utilized by check dam agriculture located in steeper arroyos. In this case, flatter areas in drainages were planted, where a raised water table was also useful to the cultivator.

One disadvantage to such sites is cold air drainage into these canyon bottoms. The accumulation of cold air makes these sites susceptible to late spring and early fall frosts, limiting the length of the growing season. Other disadvantages limiting use of these areas are the danger of floods wiping out fields and the difficulty of clearing the thick riparian growth.

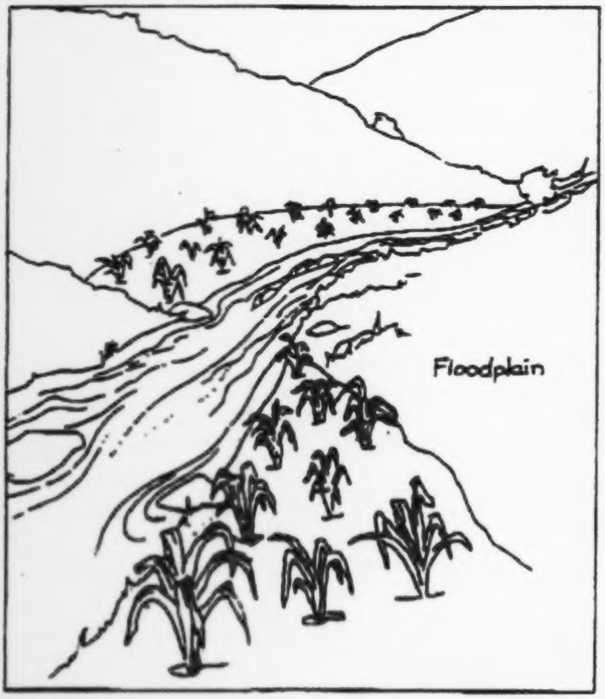
Often brush weirs or earthen walls were used to slow or spread water across the fields. This led to irrigation which spread the water over more land enabling more crops to be grown with more control.

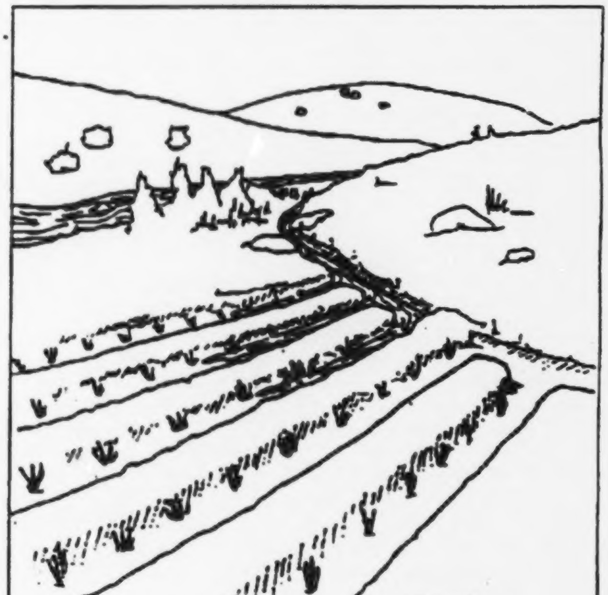
Irrigation

That there was irrigation before the arrival of the Spanish is clear. Its exact extent and character is not. What we do know is that it was not as universal a trait of Pueblo agriculture in the past as it is now, and was only one of a wide range of farming techniques used.

It is not clear to what extent the Rio Grande and other large rivers in northern New Mexico were used prehistorically for irrigation. Modern farming eliminates the evidence of previous irrigation systems and scholars do not agree on the documentary evidence. At Santa Clara Pueblo, the looser soils in the canyon and immediately surrounding the village, seem to have been preferred sites for irrigation. These areas were watered by Santa Clara Creek.

As late as 1940, almost all irrigated fields were located in the vicinity of Santa Clara Creek. There appears to have been only a gradual shift of landholding from the area around the pueblo to the river bottom, indicating that at Santa Clara, river bottom cultivation was one small part of Pueblo agriculture. Typically, fields were scattered across the landscape at different elevations and in different environments to prevent a disaster from destroying all of the crops.





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The Hohokam of southern Arizona built substantial irrigation canals to divert water from large rivers, but the eventual failure of these projects contributed to the destruction of their "advanced" civilization. In the Anasazi area, dry farming seems to have been the rule, and irrigation was small in scale compared to the Hohokam.

Following the Anasazi through time

The appearance of the various farming techniques through time gives us a view into the environmental effects of Anasazi agriculture and their responses to these effects. Originally simple swidden agriculture was practiced. Land was cleared, burnt and planted. As it was exhausted, new land was cleared. Eventually the original plot recovered and could be replanted. This extensive clearing increased erosion. Check dams and linear borders were being constructed late in the occupations of Chaco, the Mimbres area, the San Juan Basin, and other sites, such as Pot Creek Pueblo near Taos. These structures were apparently an attempt to halt the serious erosion caused by deforestation and clearing, the use of wild plants, and foot traffic. Despite these conservation attempts, these areas were ultimately abandoned. When a prolonged drought struck in A.D. 1276-1299, the food production systems were already under stress from the high population densities. The combination of the drought with the environmental degradation caused by heavy farming and residential use probably led to final abandonment of settlements.

Refugees from these areas built grid gardens, techniques intended to prevent the start of erosion. Rather than waiting for erosion to begin, farmers were now attempting to stop the process at its source before it began, an example of Anasazi farmers learning from past mistakes and adapting to their environments.

As noted above, at an earlier time, the Anasazi had rotated fields, farming one until it was exhausted, and then clearing another, and so on until they returned to the first many years later. However, as populations increased, the inhabitants were forced to use all available farmland in proximity to their villages. This forced the Anasazi to be somewhat nomadic, moving every 60 to 100 years when they had depleted a site's soil and other natural resources. After a period of time, the original group or another group could reinhabit an area, the soil fertility and natural resources having recovered from previous usage. This is a key part of pre-Columbian Pueblo land use patterns. Even after the adoption of corn, squash, and beans led them to a sedentary life-style in villages, they continued to be seminomadic at a much slower pace.

It was continuous habitation and the associated large scale populations, irrigation systems, building projects, deforestation, and soil depletion which contributed to the forced migrations of the 1300s. The land taught the Anasazi to keep things small and to move occasionally to allow it to rest. By remaining fluid within their environment, by using many techniques in various locations, microclimates, and elevations, and by maintaining an appropriately small scale, the Anasazi were able to survive where earlier growth and urbanization had failed. It is ironic that rather than learning from what has failed before and adopting what has succeeded, we have done the opposite. Like the Chacoans and Hohokam, we believe that our technical "advances", power, and grandeur make us exceptions to the constraints of our environment. And, just like them our failure will come to us as a surprise.

Editor's note. This article is an edited excerpt from a book to be published by Flowering Tree Permaculture Institute, called *The Corn is the Same as the People, A History of Santa Clara Pueblo Agriculture* by Joel Glanzberg.

ANIMALS IN SUSTAINABLE SYSTEMS

. BY JOEL GLANZBERG

Many people think that vegetarianism is the solution to world starvation and land degradation. It might be except for the concentration of annual plants it requires, and the resultant habitat destruction, soil loss, and energy consumption. Animals can live from a much greater variety of perennial and native or adapted plants than we can. Particularly in the high desert, one would be hard pressed to live entirely from perennial vegetarian foods. In this environment, extensive cultivation of annual grains and pulses would probably be necessary to fulfill human protein needs. This is not true of other animals.

While extensive annual cultivation is undertaken to feed grain to animals, this is not necessary to support them. Animals can live quite easily by foraging, especially in an enriched perennial system. This is one of the roles of animals: they are translators. They can translate—or convert—a wide diversity of plants and insects into meat, milk, eggs, wool, bone, manure, and more. Of course, such foraging needs to be limited to animals appropriate to the environment where they are living, and an appropriate population density.

Animals are important members of natural systems because they are the mobile elements in these systems. They can gather nutrients from widely dispersed sources and concentrate them into high quality food and fertilizer. They can disperse fertility across the landscape or gather it and concentrate it.

One continuing traditional integration of animals involves their ability to concentrate nutrients in manure. The Tarahumara of Mexico often build movable corrals of poles, stacked like Lincoln Logs ®, to house their sheep and goats at night. The animals are shepherded about during the day by children and dogs; at night they are penned up in the corrals. These corrals are built in the fallow fields and are moved periodically to manure the fields. In the words of Robert Zingg:

"In a very real sense, the Tarahumara lives on the sparse grass of the mountain side collected for him by the animals and transformed through the cycle of animal food to a fertilizer for the corn which is the staff of Tarahumara life. This is the most elaborate, delicate, and laborious adjustment of culture to natural environment in their ecology." (Dobie, et al., 1938)

Reference

Dobie, J. Frank, Mody C. Boatright, and Harry H. Ransom, eds. "Christmasing with the Tarahumaras", in *Coyote Wisdom*. Austin, Tex.: Texas Folklore Society Publications, no. 14, pp 207-224, 1938.

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Revitalizing Barren Ground: A Succession Model

Damaged soil and vegetation return to health using this innovative technique modeled after the process of recovery in natural systems.

By Tim Murphy

PRICKLY
POPPY
ARGEMONE
MEXICANA

In 1989, Joel Glanzberg and I were invited to speak to representatives of the U.S. Forest Service about a permaculture approach to the restoration of a large area which had experienced a devastating fire.

In our presentation to the people who would be orchestrating the rehabilitation of this denuded and sterilized landscape, Joel and I made a case for beginning the restoration process by sowing quick-growing annual pioneer seed. We suggested that high germination rates and good dispersal could be achieved through using an inexpensive seed pelletization process (see PDJ No. 19). Conventional practice at that time was to sow grass seed to hold the exposed soil in place. Our contention was that it is important not only to stabilize the soil mechanically, but also to begin the process of restoring the complex web of soil life which the fire had destroyed. Planting pioneers such as prickly pear, datura, prickly poppy, buffalo gourd, locoweed, thistle, and amaranth, we argued, would accomplish that objective and also begin the re-establishment of soil micro and macro fauna. We suggested that the shoulders of roadways traversing the forest serve as beds for growing the pioneer seed stock for such emergencies. Later, less tolerant and robust elements could be established, as niches were created for them by their tough antecedents.

The strategy we described that day applies equally to a variety of situations where the soil life has been disrupted. A succession model can be used at any scale, in similar situations, as a cheap energy- and resource-efficient approach to land reclamation.

The succession model described in this article is based on natural succession processes, where pioneer vegetation springs to life in areas that have been scarred, such as the site of a landslide or other earth disturbance. Many pioneers are broad leafed, fast-growing annuals, ideally suited to taking root in exposed soil. Pioneers typically develop large and aggressive root systems which penetrate compacted, deeper soil layers. Nutrients from the subsoil are incorporated in the pioneer stem, leaves, and roots, and are deposited into the soil as micro and macro fauna break down plant material at the end of the annual cycle. Additionally, new research appears to confirm that pioneer plants contain symbiont spores in their seed material (see PDJ No. 19).

In nature, the energy flows of wind, water, and animals disperse pioneer seeds. Upon sprouting, each pioneer seedling sends its aggressive root deep into the soil where moisture levels are higher than at the surface. In contrast to other types of plants, pioneers create a large amount of biomass, both below and above ground, from a minimum amount of water. Pioneers produce a large canopy which shades and cools the exposed soil, and shelters it from the impact of raindrops. The pioneer plant interrupts energy flows such as wind and water, causing deposition of wind and water-borne duff and dust, collecting nutrients for the next phase of plant life.

All these characteristics of pioneers result in a phenomenal leap in soil quality and fertility, characterized by increased permeability, aeration, moisture retention, moderation of temperature fluctuations, increased availability of nutrients, and the presence of soil micro and macro fauna. This exponential increase in soil life lays a foundation for the growth of perennials later in the succession process.

In the second stage of successional revegetation, perennial plants begin to take root in the awakened soil areas. Pioneer vegetation eventually dies out as higher levels of succession are reached. But pioneers continue to work the edge—the place where the developing system meets still-barren areas, constantly expanding the favorable conditions that support the life that follows. Eventually the scar or disturbance heals as successively more complex levels of vegetation are reached.

In applying this model to deliberate restoration efforts, we use design rather than chance in choosing and placing successional elements, as well as in timing their planting. We want to select the most ideal species for the circumstances and consciously exploit site advantages and climate opportunities. Ideally, we would combine pioneers into polycultures whenever possible. For example, mixing nitrogen-fixers with grain producers (such as a stand of deer vetch and amaranth) would be preferable to planting a grain producer alone, as the paired plants have a mutually beneficial relationship and yield will be increased from the association. Diverse elements place different demands on soils and accrue a variety of benefits.

If possible, we can position plantings so that wind and gravity can aid in dispersing their seed, but if so, we should remember that many pioneers are perceived as noxious weeds or dangerous plants. It might be unwise for neighbors of ranchers, for instance, to plant locoweed upslope of the neighbors. Deer vetch or lupine would perform the same companion nitrogen-fixing function while avoiding controversy in the neighborhood.

The pioneer and second stage lists are a starting point for selection (see sidebar). The selection of individual species from the list of recommended genera will depend on local conditions; some research into what grows locally will be necessary. Species selection is site-specific and should not only reflect the needs of the soil, but also support other elements in the particular system in which they are deployed. Some pioneers have medicinal uses or food value for animals and people. In rural and semirural applications, various pioneers can provide

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forage for wildlife, grazing animals or poultry. These characteristics are noted in the species lists. To begin restoring a denuded area:

- **Create catchments.** Swaling, pitting, and land imprinting are all ways of creating catchments.
- **Seed with pioneers.** Seed pelletization and grenading (lobbing seed heads or ripened fruits at hillsides and hard-to-reach areas) are time-efficient techniques for sowing seed. Seed pelletization, in particular, allows high and even germination rates with minimum effort.
- **Evaluate.** Before plants develop seed heads, evaluate how much bare ground remains. If pioneer stands have completely covered bare areas, the planting can be mown or selectively grazed before pioneers re-seed, and second-stage seeds can be sown for the next season's growth. If bare areas remain, pioneers can be allowed to re-seed before second-stage perennials are planted.
- **Seed with second-stage perennials.** The same seeding techniques apply, but the need for catchment is less due to increased water retention in the soil.
- **Plant shrubs and trees.** Plant in favorable locations, such as existing catchment areas. (Favorable locations will be obvious due to rampant growth there.) New catchments of appropriate scale can create favorable conditions in locations that also would facilitate seed distribution.

Suggested Reading

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SPECIES LISTS FOR RESTORATION • BY TIM MURPHY

Note: These lists reflect plants which are suited to mid-elevation ranges in the southwestern U.S.; research into appropriate species for your region is recommended. Use as references wildflower, medicinal plant, and weed field guides, and information from native plant societies.

Pioneer Species

Common Name	Family	Genus and Species	Notes
pigweed	Amaranth	*Amaranthus (several)*	AEMPRSX
red dock	Buckwheat	*Rumex hymenosepalus*	AEMPSX
prickly pear, cholla	Cactus	*Opuntia (many)*	AECPRX
filaree, cranesbill	Geranium	*Erodium fremontii*	MPS
lambsquarters	Goosefoot	*Chenopodium album*	AEPS
buffalo gourd	Gourd	*Cucurbita foetidissima*	EGRX
thistle	Sunflower	*Cirsium (many)*	EPRWX
locoweed	Pea	*Astragalus (several)*	NRSX
prickly poppy	Paperflower	*Argemone (several)*	EMPRSX
globemallow	Mallow	*Sphaeralcea (several)*	AMS
little mallow	Mallow	*Malva parviflora*	AMS
broadleaved milkweed	Milkweed	*Asclepias latifolia*	EPRWX
arugula, rocket	Mustard	*Eruca sativa*	AEPS
black mustard	Mustard	*Brassica nigra*	APSX
tansy mustard	Mustard	*Descurainia sophia*	AEPS
sacred datura	Nightshade	*Datura meteloides*	GM*SX
nettle	Nightshade	*Solanum elaeagnifolium*	GPSX
California poppy	Paperflower	*Eschscholtzia californica*	AMPS
deer vetch	Pea	*Lotus (many)*	NS
Indian wheat	Plantain	*Plantago purshii*	AEMPS
verbena	Vervain	*Verbena (many)*	MPS

Second Stage

Common Name	Family	Genus and Species	Notes
bee plant	Caper	*Cleome (several)*	ENPRS
evening primrose	Evening Primrose	*Oenothera (several)*	AMRS
mullein	Figwort	*Verbascum (several)*	EMRS
four-o'clock	Four-o'clock	*Mirabilis multiflora*	AMPS
grama grass	Grain	*Bouteloua (several)*	APS
buffalo grass	Grain	*Buchloe dactyloides*	APS
blue-eyed grass	Iris	*Sisyrinchium (several)*	APRS
horehound	Mint	*Marrubium vulgare*	EMS
wild oregano	Mint	*Monarda menthaefolia*	EMPRS
bee balm	Mint	*Monarda pectinata*	EMPRS
lupine	Pea	*Lupinus (several)*	AENPRS
sweet clover	Pea	*Melilotus officinalis*	AENPS
wild tepary bean	Pea	*Phaseolus acutifolius*	AENP
devil's claw	Unicorn-plant	*Proboscidea parviflora*	EGPS
perennial sunflower	Sunflower	*Helianthus (several)*	PSX
dandelion	Sunflower	*Taraxacum (several)*	AEMPWX

Key to Notes:
A = animal forage
E = edible
G = suitable for grenading
M = medicinal use
N = nitrogen-fixing
P = poultry forage
R = mycorrhizal
S = suitable for seed pelletization
W = wind dispersed
X = considered noxious

*Caution: psychotropic and poisonous

Harvesting Rain Runoff on Your Property

Controlling runoff from private property is not difficult, and it does not have to be expensive. You can create a pleasant and lush landscape around your home without using increasingly taxed municipal water supplies.

By Kirk R. Vincent and Laurie Wirt

Adapted from Vincent, K. R., and Wirt, L., Urban Runoff—Lessen the Strain on Public Works by Using That Water at Home. *The Arizona Hydrological Society Newsletter*, v. 10, p. 1-3, 1993.

In urban areas storm water often flows off private property and floods the streets. That runoff—precious water—is a lost resource. However, the water can be harvested using simple and effective methods that reduce both street flooding and dependence on municipal water supplies. In this article we discuss the basic techniques to harvest runoff for watering landscapes and gardens using examples from our home in Tucson.

Even in our desert setting the volume of rainfall is surprisingly large. Tucson receives about 10-12 inches of rain per year, but that takes on new meaning when converted to gallons falling on an area. For example, our small (1/4-acre) lot receives about 67,000 gallons of rainwater per year. For comparison, the average single-family Tucson residence (assuming three people) uses about 120,000 gallons per year, and roughly half of that is for exterior use (Foster et al., 1988; after Brittain and Karpiscak, 1986). This suggests that we could satisfy all of our exterior water needs by harvesting the rain that falls on our property, and indeed we are attempting to do just that within some practical limitations.

A basic principal of water harvesting is to direct runoff to a place where it can be directly utilized. For example, when we built our chicken coop we inclined its small roof so that runoff would drain onto a grapevine. It is easier to design water harvesting into a new project, but, as we learned, retrofitting is neither too difficult nor too expensive.

There are three basic techniques for controlling and utilizing runoff: water-retention topography, storage tanks, and infiltration enhancement. The appearance of water-retention topography can be highly variable (Mollison, 1990), but the principle is simple: obstruct overland flow by placing in its path high topography (an earthen berm or masonry wall), or in some other way pond the runoff, until the flow can infiltrate into excavated swales or topographic depressions. If the ground is level, a berm around the perimeter of the lot is sufficient, but our lot slopes, so we employed something like "contour farming." While landscaping our front yard for desert vegetation, we constructed several paired swales and berms that follow topographic contours. We piled the dirt from each swale downslope to make the berm until the berm was about six inches higher than the swale. As a variation on the theme we also built walkways of wide berms with adjacent depressions for vegetation. This technique cost nothing but our sweat—we suggest doing it when the soil is moist. In addition, while building a fence in the back yard we made the concrete footing into a short wall extending about 10 inches above the original ground surface. We filled the upslope side of the wall with extra dirt, in effect creating a water-retaining terrace.

Storage of roof runoff in tanks is an ideal approach in the desert because our rainfall is highly seasonal and variable, while garden plants need regular watering. We installed a rain gutter on our garage and placed a 55-gallon drum under the downspout. It cost about $40 and is one of the simplest tank-storage methods. The drum overflows during large storms, but storing some runoff is better than nothing. Our garage roof is 20 by 22 feet and sheds about 3,000 gallons of roof runoff per year (see sidebar). To efficiently use that water on gardens we estimate we would need a 1,000-gallon tank, but such storage tanks are expensive, costing up to 50 cents to $1 per gallon (Gelt, 1993). With Tucson city water available at about $2 per 1,000 gallons, one will not receive a direct monetary return on an investment in large storage tanks. However, there is an intangible value for avid gardeners. Tucson's water will become saltier in the future and gardeners are concerned about salt buildup in their soils. That problem could be solved by occasional flushing of garden soil with relatively pure roof runoff.

The final technique for controlling and utilizing runoff is infiltration enhancement—increasing the rate at which water soaks into the ground. Our house roof (1,400 square feet) annually sheds about 10,000 gallons of water through two downspouts. We wanted to plant fruit trees and create a low-maintenance watering system that did not use much city water. Large storage tanks were financially not feasible, so the solution was to construct a subsurface drain and leach field off both downspouts (see figure). First we decided on the location of two rows of trees. Then we marked the location for the leach field trenches about 5 feet away from, and parallel to, each tree row. We excavated the trenches 12 to 18 inches wide and 2 to 3 feet deep. Then we extended each trench to a downspout, and placed in them a drain line consisting of 6-inch diameter plastic (PVC) sewer pipe. The drain inlet is a vertical section of pipe with an aboveground, screened opening under the downspout. Within the trench section extending from the inlet to the tree row, the drain is solid sloping pipe. This is connected to a horizontal section of perforated pipe along the tree row. The "perf-pipe" is purchased with two rows of holes, although only one row is visible on the figure. Each hole is about 3/4 inch in diameter. We put a cap on the end of this leach field pipe; the result is that as water builds up in the pipe it flows out of all of the holes at about the same time. We drilled a few 1/4-inch holes along the underside of the leach field pipe so it would drain completely between storms. The leach sections of the trenches were packed with clean, 3/4-inch gravel to the top of the pipe and the remainder of the trenches were backfilled with earth. The cost of this project was $350, including rental of a miniature backhoe which made the job easier. The utility of the system is that it accommodates all of our roof runoff, and directs it underground to where it can sustain our trees. The trees may not access all of the water, but what they don't use will infiltrate rather than flowing into the streets and ultimately the sewer system. Another recent home project was a patio which will also generate surface runoff, so we inclined it toward an infiltration bed, also shown on the figure, that is connected to the leach field.

Controlling runoff from private property is not difficult, and it does not have to be expensive if one is willing to exert a little effort. Our efforts have been quite satisfying in that we are fostering a pleasant and lush landscape around our home without taxing municipal water supplies.

CALCULATING ROOFTOP RUNOFF

To calculate rain running off the garage roof in this article,
First, calculate the area of the roof:
20 ft wide x 22 ft long = 440 sq ft
Second, find out the average yearly rainfall in feet:
at Kirk's and Laurie's house its about 10-12 inches/year, or 11 inches on average:
11 in/yr ÷ 12 in/ft = 0.92 ft/yr of rain
Third, calculate cubic feet of runoff water from the roof:
440 sq ft of roof area x 0.92 ft/yr of rain = 405 cubic ft/yr of runoff
Fourth, convert cubic feet of runoff to gallons:
405 cubic ft/yr x about 7.5 gal/cubic ft = 3,036 gal/yr of runoff

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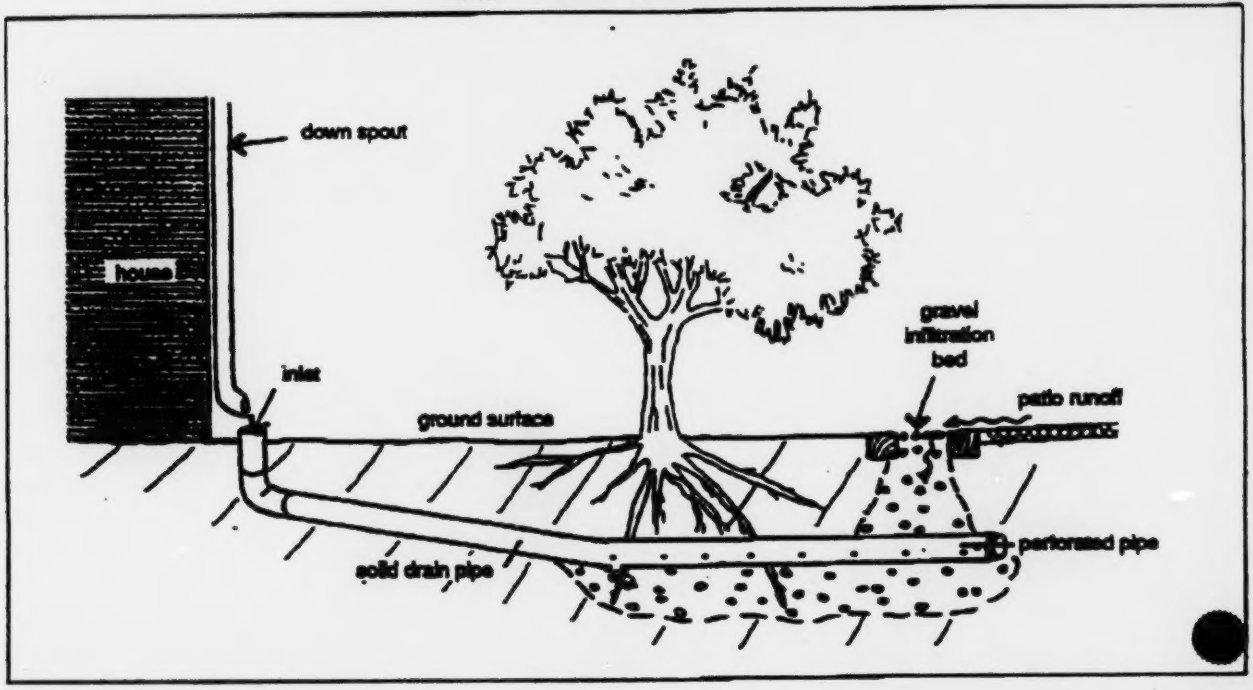
A leach-field drain harvests roof runoff and passively waters trees. The trench was packed with gravel before placing the perforated section of pipe. A gravel infiltration bed for harvesting surface runoff is also shown.



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WATER SMART LANDSCAPING

Water Smart Landscaping (also known as Xeriscaping™) allows us to utilize water both efficiently and wisely. El Paso receives approximately 8 inches of rainfall per year. The high summer heat and low humidity make it necessary to irrigate our landscape plantings. Currently almost half of water used by residents is used for landscaping.

Our landscapes do not have to be devoid of trees and other plants to be water smart. Indeed, the absence of trees in the landscape can result in higher water and utility costs because of the extra cooling necessary to maintain a comfortable living environment. With the following seven principles, trees can provide a comfortable environment with minimal additional water use.

1. Planning and Design

Planning and design may be the most important step in developing or renovating your landscape. By analyzing your site and making an appropriate design, trees can perform a variety of functions. Smaller trees can be used for screening, larger trees for shade and protection. Deciduous trees (trees which shed their leaves in the winter) should be placed to provide shade from the afternoon summer sun while letting the winter sun provide heat. An especially important consideration is the mature size of a tree. Make sure that the tree is placed where it has space to grow and mature. This helps avoid future maintenance problems such as the severe pruning of large trees located under power lines.

2. Appropriate Turf Areas

In landscaping, it's important to consider the needs of both your turf and trees. Avoid planting deciduous trees in an evergreen turf area which needs year-round irrigation. And don't put an evergreen tree in a winter dormant turf which only needs water in the summer. These situations can result in either over or under watering of the tree. In most areas of El Paso, trees and shrubs should be separated from the turf areas and turf should be limited to areas that are functional rather than decorative.

3. Efficient Irrigation

A well planned irrigation design can significantly reduce water use. Placing trees in areas which receive water run-off can provide most of the water an established drought tolerant tree needs. An ideal irrigation design has trees in a separate irrigation zone from the shrubs and flowers. Irrigation zones should be designed so that plants with similar water use requirements are grouped together. One example would be to place evergreen trees and deciduous trees on separate irrigation zones. This allows you to provide winter water for evergreen trees without unnecessary watering of deciduous trees.

4. Soil Improvements

The most current tree planting research indicates that altering or correcting the existing soil provides no benefit and may actually be detrimental. Appropriate plant selection will alleviate many of the growth problems associated with soil conditions. For instance do not plant a tree that requires good drainage in heavy clay soil.

5. Mulches

Mulches can be organic (bark chips or wood grindings) or inorganic (rock, gravel, or chat). Mulches cover the soil and decrease evaporation, reduce weed growth, slow soil erosion and provide landscape interest. Neutral colored mulches are preferable to either dark or light colored mulches. Dark mulches increase the upper root zone temperatures dramatically while light colored mulches cause excessive reflected light. Both of these conditions are harmful to trees especially during the establishment phase.

6. Use of Trees with Low Water Requirements

There are many low water use trees available for a variety of landscape functions. Some trees provide shade and texture, others act as screens and a few provide seasonal color. Ideally, established low water use trees will need only occasional supplemental water to perform their function for your landscape.

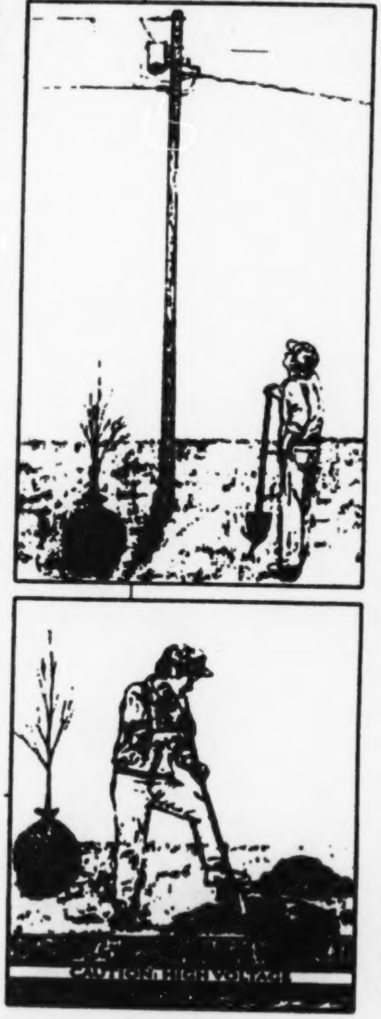
7. Planning and Maintenanc[illegible]

Many maintenance problems [illegible] be avoided at planting. The right tree for the right location will minimize future problems. This means choosing trees appropriate for your soil and avoiding trees that have pest or disease problems or that cannot easily adapt to our weather conditions. And finally, after you have planted your trees, follow the cultivating practices described in other sections of this tree guide.

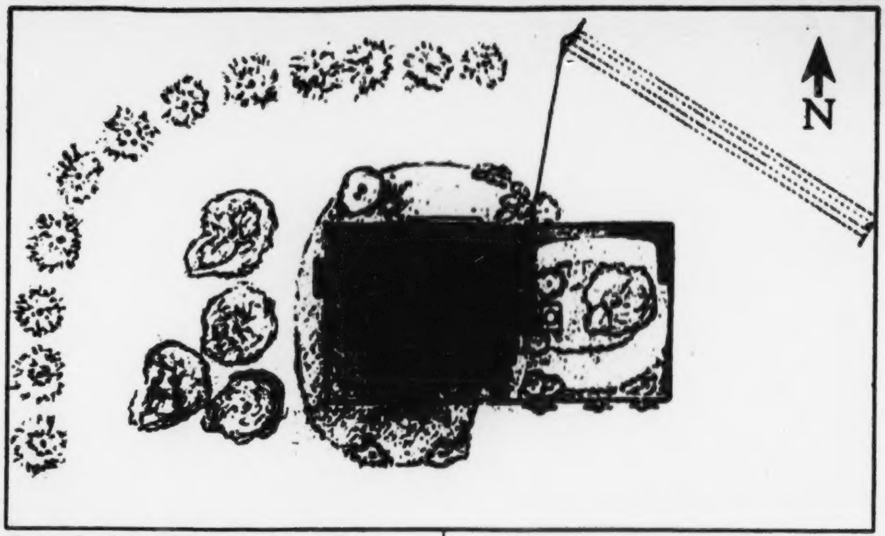
TREES AND POWERLINES

Flip a switch, push a button, turn a knob and we have light, entertainment, or heat. We rely on a source of energy and take electricity for granted. W[illegible]his source is [illegible]orarily removed, it disrupts our daily lives.

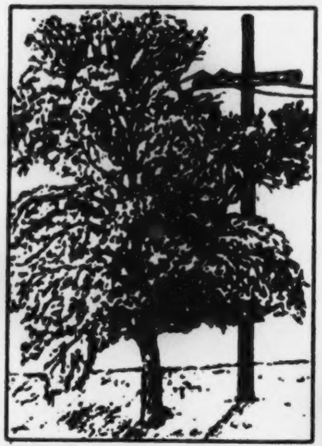
One of the major reasons for losing power during a storm is damage from trees and branches falling on distribution lines. Planting a tree which will grow into the power lines costs us all



LOOK UP – Make sure there are no overhead utility lines.
LOOK DOWN – Call your utility company to l[illegible] buried power[illegible]



Draw a landscape plan and decide – before you dig – where your new tree can best be placed.



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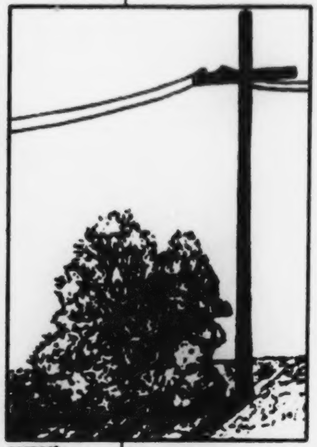


correct

more money in the long run. In order to assure uninterrupted service, electric companies must prune and remove branches and trees which might interfere. There is also a safety factor. A tree or branch touching a power line can act as a conductor and seriously injure a person in contact with that tree.

Properly placed, trees will help both you and the utility company. They conserve energy, avoid problems which might interrupt service and provide a better environment for all. So please ... think before you plant!

If your only alternative to plant is under or near a power line, know the mature size of the tree you're planting. Only small shrubs or trees which grow no taller than 15 feet can safely be planted directly under utility lines. Small trees, with a mature height of 25' or less, can be planted near power lines without interference. Medium and large trees should never be planted under power lines.

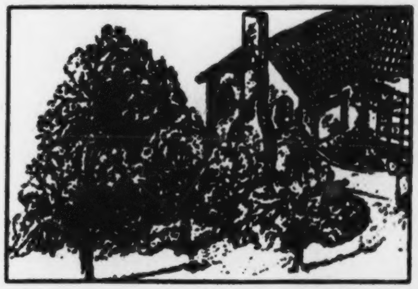
REMEMBER, SMALL TREES GROW!

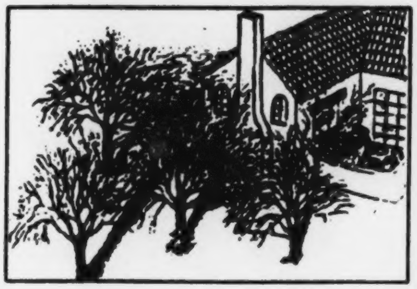
ENERGY CONSERVATION

Here in the Southwest, peak demand of electricity is highest late in the afternoon on hot summer days. Most power plants burn fossil fuels which add CO_2 (a greenhouse gas) to our atmosphere. Power plants use more water which evaporates in their cooling towers to meet our increased energy demands. Knowing that trees planted today will reduce our future energy needs, electric companies across the nation actively support tree planting projects and programs.

Energy conservation is one benefit of trees many people fail to recognize. Research shows rural areas are usually five to nine degrees cooler than the "Urban Heat Islands" we call cities. Studies indicate that by strategically planting three trees around your home, cooling costs can be reduced up to 50 percent.

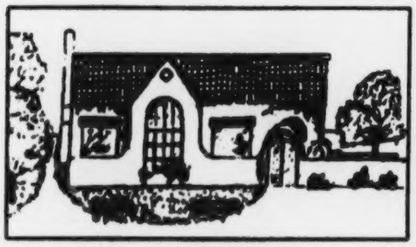
Some communities are involved in a "Cool Communities" program. This brings a dollar and *sense* value to strategic tree planting (in combination with lightening dark colored surfaces) to save money and energy. Here are some guidelines to follow for energy savings when designing your next landscaping project.





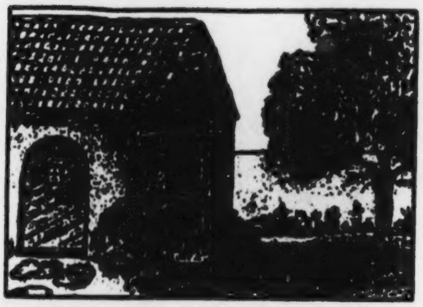
EAST & WEST ARE BEST

Deciduous trees on the east and west sides of your home will shade your walls and roof in the summer while letting in the sun's warming rays in winter.



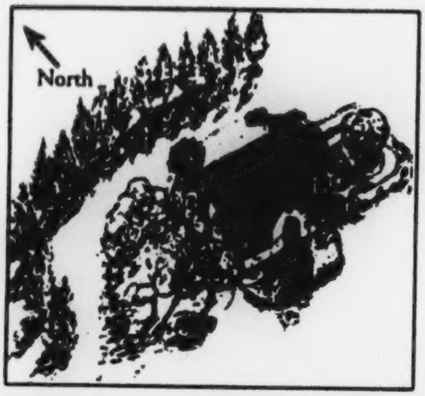
SOUTHERN EXPOSURE

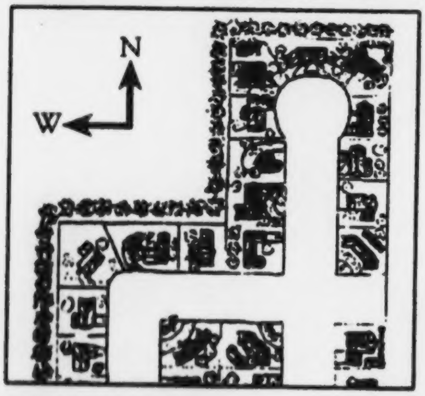
Avoid planting trees on the south side of the house. In the winter the sun is lower on the horizon and we can gather warming rays through our southern facing windows and walls. Use ground covers or low growing shrubs instead.



COOLING YOUR COOLING UNIT

Planting a small tree near your air conditioning unit will help it to operate more efficiently, while still allowing for air circulation.





WINDBREAKS

Planting a row of evergreens on the northwest side of your lot will help deflect the cold winter winds and provide protection from the spring winds. If planting space is not available on a small residential lot, a community shelter belt may be more practical.

REMEMBER! TREES ARE NATURE'S AIR CONDITIONERS

HOW TO PLANT A TREE

SITE SELECTION QUESTIONS

1. Purpose: Why am I planting this tree? (shade, fruit, flowers, etc.)
2. Size: How big is my tree going to get?
3. Utilities: Where are my overhead and underground utilities located?
4. Views: Am I blocking a desirable view? Do I want to hide a view?
5. Area: How much room do I have for a tree?
6. Water: Where is my nearest water source?
7. Safety: Will this tree create a hazardous situation, such as blocking the line of sight in a traffic situation?
8. Sidewalks & Foundations: Will the tree roots cause problems as the tree matures?
9. Energy: Don't block your or your neighbor's solar access.

SELECTION AT THE NURSERY

Be sure you have selected a healthy tree free of insects and disease. The main stem or branches should not have numerous wounds, cracks, discolored bark or oozing sap coming from old pruning cuts.

Container grown trees can become pot or root bound if they are left in the same container too long. If you suspect a problem, inspect the roots at the nursery to see if your tree is free of circling or girdling roots.

Ball and burlaped trees should have a mulch covering the root balls keeping the roots moist. The root ball should be solid (not broken) and the stem of the tree should *not* move independently of the root ball.

Be sure the tree you have selected is recommended for this area. If possible, select a tree that has been locally grown or grown in a climate very similar to West Texas.

Know the form of the tree you're selecting. Don't pick a tree which has been topped (indiscriminate removal of major limbs) at the growers or nursery. It may look good now, but it will become a maintenance problem as it matures. If your tree has a dominant growing point (such as pines), do not select a tree with double leaders.

Before buying a staked tree, remove the ties. The tree should stand erect on its own and not require the support of the stake.

TRANSPORTING: SELF SERVE OR DELIVERED – FOLL[illegible] THESE RULES

1. Never carry the tree by the trunk. Alwa support the root ball.
2. If transporting in an open air situatio *always* wrap the crown of the tree with blanket or tarp. This prevents drying, e pecially if the tree is leafed out.
3. Store the tree in a shady place, keepin the roots moist until you are ready t plant. Plant the tree As Soon As Possibl

STEPS TO PLANTING YOUR TREE

Step 1. Select your site.

Step 2. Loosen the soil around your site 3 t 5 times the diameter of the root ball to depth of 8 to 12 inches.

Step 3. Dig a hole in the center of the loosened soil, making the hole at least twice a wide as the root ball, but no deeper than th root ball. The sides of the hole should [illegible] with the top wider than the bottom. Be sur to roughen the sides of the hole.

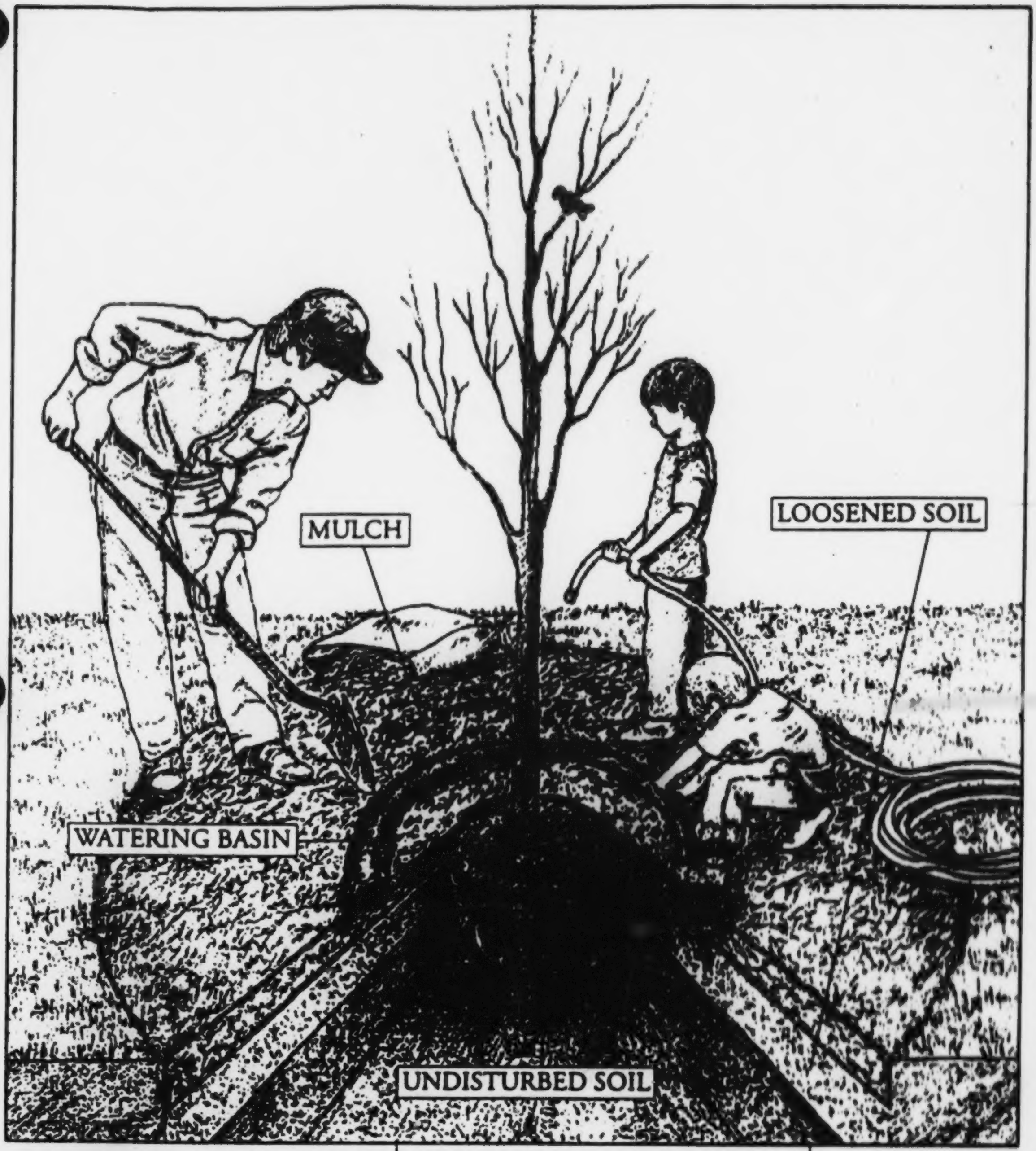
Step 4. Carefully place the tree in the cente of the hole, making sure it is plumb and th top of the root ball is at ground level.

Step 5. Be sure to remove all containers, wire burlap and string before backfilling. Check for circling or kinked roots. Root prune and gently tease the roots if this is the case.

Step 6. Backfill with the original soils unless you are planting in a very rocky site where after removing rocks there is very little soil left for the backfill. In this instance, match the backfill soil as closely as possible to the original in texture and content.

Step 7. Backfill the hole half way, gently tamp the soil and water to remove any air pockets. Backfill with the remaining soil and repeat the process. Use the excess soil to form a watering basin about 4 inches high around the planting hole.

Step 8. Staking is not necessary unless the root ball is not large enough to support the tree or if high winds are a problem. If you must stake a tree, use 2 to 3 stake[illegible]d equidistant around the tree. Make sure you do not drive the stake through the root ball. Secure the tree to the stake with a wide band



of material such as the webbing used in lawn chairs, old bicycle tire tubes or similar material. *Do not use wire!* Check your ties weekly to make sure they are properly adjusted and not rubbing or girdling the tree. Remember, staking is used to keep the tree from falling over, not to keep the tree standing up. *Do not support the tree so rigidly that it cannot sway in the wind.*

Step 9. Add a layer of mulch around the planting area. A 3 to 4 inch thick layer will help conserve moisture, keep weeds down and help keep the soil temperature at a more constant level. Organic mulches are preferable, because they return nutrients to the soil as they decompose.

CARE AND MAINTENANCE

Trees planted in urban environments are subjected to many undesirable and unnatural conditions. Growth rate and longevity are drastically slowed and shortened due to misunderstanding, old myths and improper methods of tree care. This is why as stewards of our homes and communities we need to understand the importance of good care and maintenance of our Urban Forests.

WATERING

There is no magical formula or exact rule for watering. Watering is based on the site condition, time of year, type of tree and, most importantly, soil type.

Clay soils, while taking longer to wet, will retain moisture longer. Sandy soils which easily absorb water also dry faster. **KNOW YOUR SOIL TYPE!**

Rule of Thumb for Watering: Fill the water basin, allow the water to soak in and fill again. Check the soil in the watering basin 2 to 3 days after the initial watering. Get on your hands and knees, dig into the soil and feel it. If the soil is moist, check back in a couple of days. Repeat this process until you have determined the best watering schedule for your tree. If the soil stays squishy wet, you have a drainage problem or you're over watering. If the soil is crumbly, dry and

continued

RECOMMENDED TREE LIST*

Scientific Name	Common Name	Tree Type	At maturity Height/Spread		Growth Rate	Water Needs	Benefits	Problems	Comments
SMALL TREES < 25' TALL									
Acacia farnesiana 'smallii'	Sweet Acacia	Deciduous	25'	25'	Fast	Low	Fragrant yellow flowers-spring	Spiny twigs, twig girdlers	Hardy to 10°, Filtered Shade
Cercis canadensis var. mexicana or texana	Mexican Redbud	Deciduous	20'	12'	Fast	Low	Pink Flowers-Spring	Leaf Cutter Bee	Glossy crinkled leaves, multitrunked
Fraxinus cuspidata	Fragrant Ash	Deciduous	20	12'	Fast	Low	White Flowers-Spring	Seed Litter	Lightly fragrant, Good accent tree
Juniperus scopulorum	Rocky Mtn Juniper	Evergreen	20'	12'	Slow	Medium	Evergreen	Spider mites	Long lived, many varieties
Lagerstroemia indica	Crepe Myrtle	Deciduous	25'	16'	Fast	Medium	Flowers Summer, Attractive	Powdery Mildew, Aphids, Peeling Bark	Many varieties available
Leucaena retusa	Goldenball Leadtree	Deciduous	20'	15'	Fast	Low	Yellow flowers-spring & summer	Brittle wood, palatable to rabbits when young	Multitrunked, Bright green Foliage
Pinus edulis	Pinyon Pine	Evergreen	20'	12'	Med	Medium	Compact, Heat & Cold Tolerant	Pinyon Needle Scale	Edible seed
Rhus lanceolata	Flameleaf Sumac	Deciduous	20'	15'	Med/fast	Low	Fall color	Suckers	Extended Foliage Color
Sambucus mexican	Mexican Elderberry	Evergreen	25'	15'	Fast	Medium	Evergreen, Flowers-Spring	Tent Caterpillars, Insects Summer Defoliation	Easily Trained, Attractive Structure
Sophora affinis	Eve's Necklace	Deciduous	15'	10'	Med	Low	Flowers-Spring	Poisonous seeds, Litter	Fern-like foliage, hard seed pod
Sophora secundiflora	Texas Mt Laurel	Evergreen	15'	10'	Slow/med	Low	Fragrant Purple Flowers-Spring	Poisonous seeds, insect damage in new growth	Attractive evergreen ornamental tree
Ungnadia speciosa	Mexican Buckeye	Deciduous	10'	15'	Slow/med	Low	Pink Flowers-Spring, Fall Color	Summer Leaf Scorch, Seeds mildly toxic	Attractive seed pods, multitrunked
Vitex agnus-castus	Vitex, Chaste Tree	Deciduous	25	15'	Med	Low	Lilac blue or White Flowers-Spring	Needs training, seed litter	Multitrunked tree, scented leaves when crushed
MEDIUM TREES 25'-50' TALL									
Arbutus texana	Madrone	Evergreen	25'	15'	Med	Medium	Flowers-Spring, Attractive bark, fruit	Root Rot	Reddish peeling bark, year round interest
Chilopsis linearis	Desert Willow	Deciduous	25'	15'	Fast	Low	Flowers Spring through Summer	Aphids, Seed Litter, Needs Training	Filtered shade
Diospyros texana	Texas Persimmon	Deciduous	40'	12'	Slow/med	Low	Fragrant Flowers-Spring	Fruit Drop	Attractive Bark, Multitrunk
Cupressus glabra	Arizona Cypress	Evergreen	45'	30'	Med/fast	Low	Good Screen	Bark Beetles	Adaptable, Gray Green Foliage
Juglans microcarpa	Littleleaf Walnut	Deciduous	30'	15'	Slow	Medium	Filtered Shade	Litter, Aphids	Light Green Foliage, Furrowed Bark
Parkinsonia aculeata	Mexican Palo Verde	Deciduous	30'	30'	Fast	Low	Yellow Flowers-Spring & Summer	Weedy, prolific seeder, thorny	Highly Drought tolerant, Hardy to 10°
Prosopis pubescens	Screwbean Mesquite	Deciduous	20'	15'	Med	Low	Attractive Fruit, Light Shade	Spiny Twigs, Aphids	Filtered Shade, multitrunked
Prosopis glandulosa	Honey Mesquite	Deciduous	25'	20'	Fast	Low	Fragrant Blooms, Light Shade	Borers, Thorny Branches, Twig Girdlers	Good Adaptable Tree
Prunus mexicana	Mexican Plum	Deciduous	35'	20'	Med	Low	Fragrant White Flowers-Spring Attractive Bark	Fruit Litter	Fruit prized for jams & jellies
Quercus texana	Texas Red Oak	Deciduous	50'	40'	Med	Medium	Fall color	Leaf Scorch, insects	Long Lived, good shade
Ulmus parviflora	Lacebark Elm	Deciduous	35'	25'	Fast	Medium	Attractive peeling bark, large shade tree	Minimal insect disease	Spreading crown
LARGE TREES > 50' TALL									
Carya illinoensis	Pecan	Deciduous	80'	50'	Med/fast	High	Good Shade, Edible Nuts	Brittle Wood, Insects, intolerant of poor soil	Long lived, need two varieties for nut formation
Gleditsia triacanthos inermis	Thornless Honeylocust	Deciduous	50'	37'	Med/fast	Medium	Filtered Shade	Litter, Minimal insect problems	Many varieties available
Pinus pinea	Italian Stone Pine	Evergreen	60'	25'	Med	Medium	Large yard tree	Needle scale	Rounded head, dark green color, Adaptable
Pinus eldarica	Afghan, Mondel Pine	Evergreen	80'	20'	Med/fast	Low	Fast growing	Tip moth, intolerant of poor drainage	Full form, highly drought tolerant
Pistacia chinensis	Chinese Pistache	Deciduous	50'	40'	Med	Medium	Fall color, Shade	Verticillium Wilt	Adaptable, good shade tree
Quercus macrocarpa	Bur Oak	Deciduous	75'	30'	Med	Low/med	Large Shade Tree	Leaf Scorch	Large acorns
Quercus virginiana	Live Oak	Evergreen	60'	120'	Med/fast	Low/med	Good Lawn Tree	Gall insects, Aphids	Broad Spreading Oak
Quercus muhlenbergii	Chinkapin Oak	Deciduous	60'	40'	Slow/med	Low/med	Attractive foliage, fall color	Leaf Scorch	Upright grower, good shade
Sapindus drummondii	Western Soapberry	Deciduous	50'	20'	Med/fast	Low	[illegible]l color, Shade	Suckers when young, seed litter	Very drought tolera[illegible]able

* *Not all of these trees may be loca[illegible], but all are worth locating*

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hard, you're not watering enough. Keep the soil moist throughout to a depth of 12 to 18 inches. Mulch will help.

ESTABLISHMENT PERIOD

Just because you selected a desert native tree, you can't plant it, walk away and expect it to grow on its own. All new planting need a minimum of 2 years for establishment -- 3 years is better. The water basin needs to be upgraded at the beginning of each watering season. Rebuild the sides, increase the diameter and add new mulch. After the establishment period, remove the basin and water around the dripline of the tree. This encourages lateral root spread.

IRRIGATION SYSTEMS

With drip irrigation systems, a watering basin is usually not present. The slow dripping action of the system allows water to be applied deeply without runoff. Be sure to inspect all emitters at the beginning of each season and periodically throughout to ensure proper watering. Design the system so that it can grow with the trees. A bubbler placed next to a new tree will only provide watering capabilities for a couple of years. The watering area of a tree increases annually as the root system expands laterally. DO NOT DEPEND ON IMPACT OR POP-UP IRRIGATION SYSTEMS TO PROPERLY WATER YOUR TREES!

WINTER WATERING

Don't forget to water your trees during the winter months, especially evergreens. During our mild and warm winter days, our trees will be transpiring and using moisture. Winter watering also helps with root growth. As long as the ground isn't frozen, tree roots will continue to grow. Water at least once a month from November through February.

INSPECTION

Inspect your tree on a weekly basis looking for signs of insect or disease problems. If you discover them early, they will be easier to control.

WEED CONTROL

Keep the area around your tree free of weeds and grass. Weeds and grass compete with your tree. Hand pull weeds or use a herbicide labeled as safe to use around trees. If using a contact herbicide, be sure to remove all root suckers and water sprouts around the base of the tree before applying. WEED AND FEED PRODUCTS ARE GOOD FOR GRASS, BAD FOR TREES.

STAKING

If your tree is staked, check the ties on a weekly basis and adjust them if needed. The stakes can usually be removed after one growing season. Here in West Texas, wait until the March winds have finished blowing.

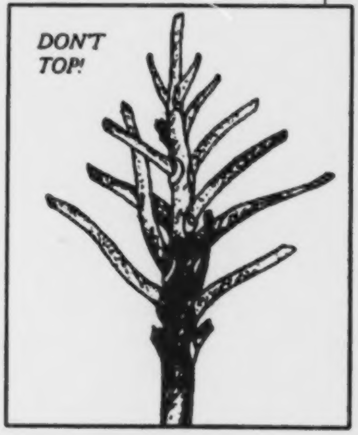
MECHANICAL DAMAGE

We are the tree's worst enemy at times, especially when we arm ourselves with mowers and string trimmers. At all times, please avoid hitting and scraping the bark of trees. Young trees especially have thin tender bark. It doesn't take a deep wound to damage the cambium (growing layer) in trees.

MATURE AND ESTABLISHED TREES

Watering: A good monthly soaking – maybe twice a month during the summer months – should be all your tree requires. Water deeply around the dripline of your tree. Place a trickling water hose on the ground so that the water can penetrate deep. Move the water hose around the tree until entire root system is wet.

Fertilizing: In West Texas, nitrogen and organic matter is usually lacking from our soils. So that you're not guessing, have a soil test done. This will tell you what is lacking and what is present in the soil. You can save money and time by correctly applying or not applying the proper fertilizer. Most mature trees in lawn situations receive the nutrients needed from lawn fertilizer applications.



PROPER PRUNING – HELP SAVE OUR SHADE!!!

The term pruning has almost becon synonymous with topping (especially wi mulberries). It shouldn't be that way. Mo people follow by example and there are a l of *BAD* examples which are being used the norm.

Pruning is an art. When you finish pru ing your tree, the beauty of its natural sha should still be intact. Don't prune just prune or because it's "that time of year."

Mature trees, for the most part, shoul be on a 5-7 year pruning cycle. Young newly planted trees should be placed on yearly pruning schedule for the first 5 yea to catch potential problems. Follow th guidelines in our pruning section and b come a Topper Stopper.

PRUNING PRINCIPLES

- Always know *WHY* you're going to prun
- Never, never *TOP* your tree.
- Know *WHEN* to prune.
- Always use the *PROPER* tool.
- Always make proper *PRUNING CUTS.*
- If you need *HELP*, hire a qualified arboris (THINK SAFETY FIRST).

REASONS TO PRUNE

- Removal of dead branches and limbs
- Removal of disease or insect infested limb
- Repair storm damage
- Ensure good structure and branch scaffolding (training young trees).
- Control the size of the tree, (if you hav planted the wrong tree in the wrong spot)
- Promote fruit and flowers.

"I have to top my tree, it's too big, the wind will blow it over."

STOP! DON'T TOP!

Trees only get as big as they are ge netically capable.

By topping a tree you will:

- Encourage thicker regrowth whic will catch more wind than if the tree wa properly pruned.

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- Encourage new growth which is weakly attached and increase the chance of limbs breaking.
- Create large and numerous wounds which rarely callus and close properly and will act as doorways for insects and diseases.
- Removed the food source for the tree. It then has to call on stored reserves to create new branches, buds and leaves in order to survive
- Create a maintenance nightmare and actually spend more money and time to keep your tree alive.
- Add unnecessary material to your local landfill, shortening it's lifespan.
- Shorten the lifespan of the tree and removed much of the tree's shading potential.

WHEN TO PRUNE

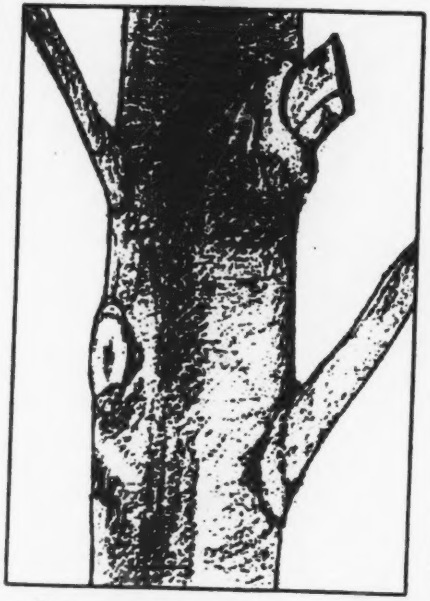
- Light pruning, removal of small or a few limbs, can be done anytime.
- Most pruning is done when the tree is dormant, after leaf drop or early spring before bud break.
- Spring flowering trees should be pruned after flowering, otherwise you will remove the flower buds which form on old wood.
- Summer bloomers like crepe myrtles bloom on new wood and should be pruned before bud break.
- Heavy pruning in late spring to mid-summer will stunt the tree's growth

THE RIGHT TOOL FOR THE JOB:

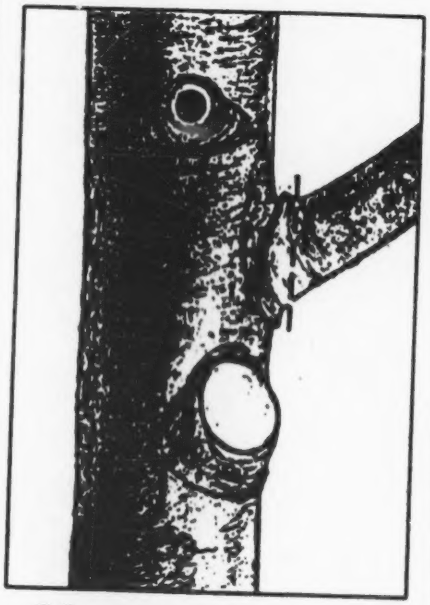
- Hand pruners are for cutting small branches less than 1/2 inch diameter.
- Hand loppers are for medium branches 1/2 inch to 3/4 inches.
- The hand saw is for limbs 3/4 inch to 3 inches.
- Use a bow saw or small chain saw for branches greater than 4 inches.
- Pole saws are for hard to reach high branches.
- Sterilize your tools before pruning and before moving onto a new tree. Use a 10% bleach/water solution or alcohol as a disinfectant.

ALWAYS KEEP YOUR TOOLS SHARP!!

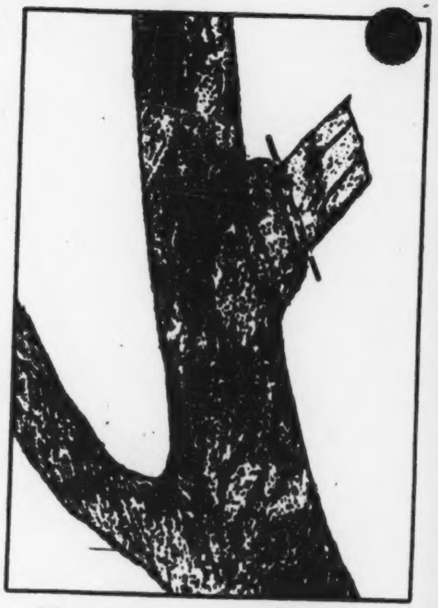
MAKE PROPER PRUNING CUTS



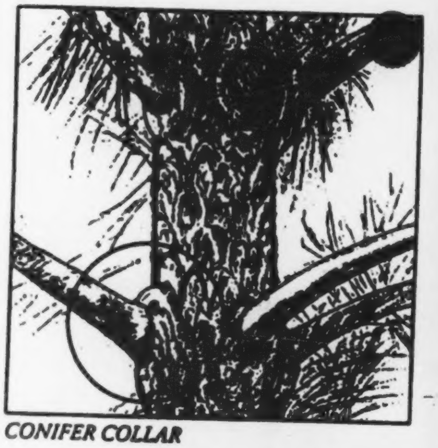
Flush cuts or leaving stubs encourages rot and decay.



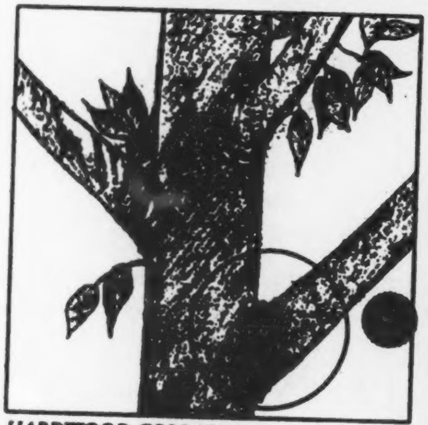
Collar cuts encourage better wound closure and keep the tree's natural protection zone intact.



When removing old stubs, take care not to cut into callus (living tissue). Remove only the dead portion.

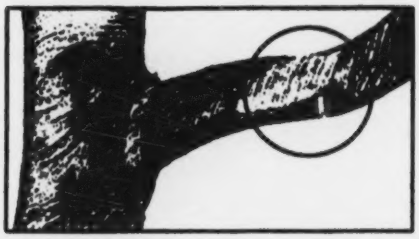


CONIFER COLLAR

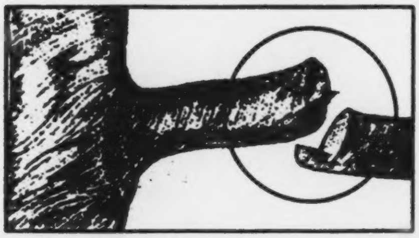


HARDWOOD COLLAR

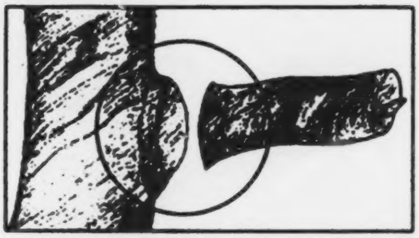
Removing limbs 3/4 inch or larger requires a three step process which will prevent the ripping and tearing of bark.



Step 1: Begin with an undercut about 1 to 2 feet from the main trunk, cutting up about 1/3 of the way through the branch.

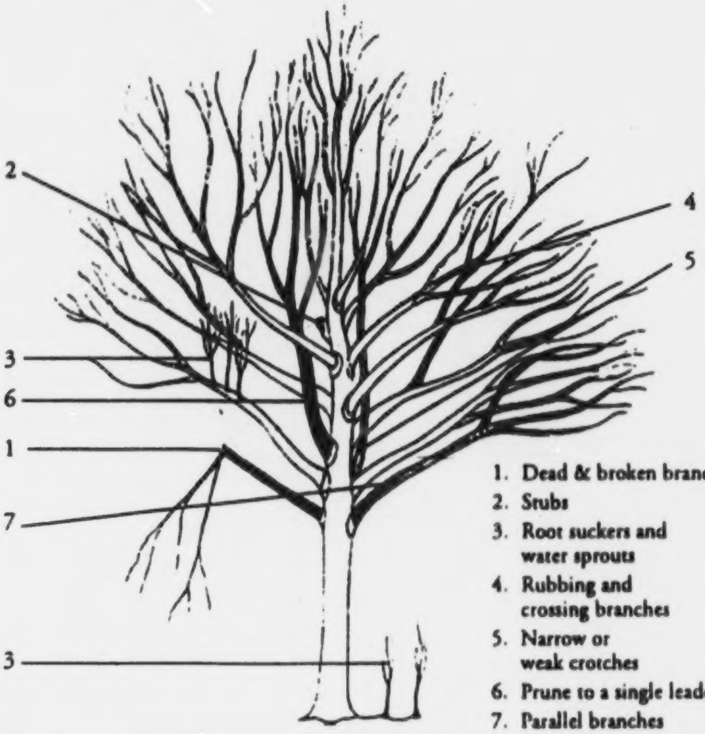


Step 2: Start the top cut approximately 1-2 inches from the undercut, cutting down through the branch.

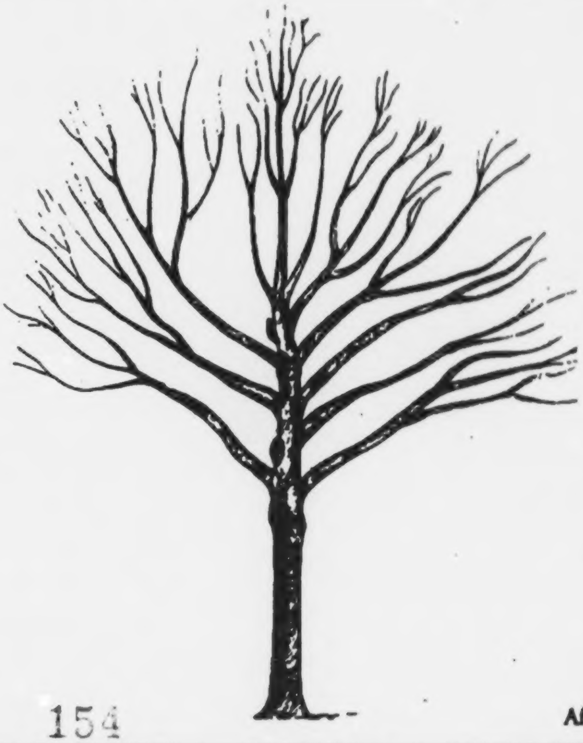


Step 3: The final cut is made just outside the branch collar. Remember to support the stub.

WHAT TO PRUNE



1. Dead & broken branches
2. Stubs
3. Root suckers and water sprouts
4. Rubbing and crossing branches
5. Narrow or weak crotches
6. Prune to a single leader
7. Parallel branches



After Pruning

COMMON TREES AND THEIR PROBLEMS

Globe Willow (*Salix matsudana* 'Umbraculifera') Bark aphids, Borers, Chlorosis, Slime Flux, Shallow Rooted, High water user

Cottonwoods (*Populus* sp.) Seed litter, High water user, Mistletoe, Webworm, Crown gall, Cytospora, Chlorosis, Leaf miners, Invasive roots, Leaf spot diseases

Ashes (*Fraxinus* sp.) Chlorosis, Seed litter, Eriphied mites, Whitefly, Ash caterpillars, Mistletoe, Cytospora, Acthracnose

Mulberry (*Morus* sp.) Invasive root systems, Webworm, Crown rot, Sensitive to herbicides, Excessive pollen for male trees, Sooty canker disease, Slime flux

Chinaberry (*Melia azedarach*) Excessive seed litter, Invasive suckers, Poisonous fruit, Brittle wood

Purple-leaf plum (*Prunus cerasifera* 'Atropurpurea') Borers, Cholrosis, Heavy seed crop

Ornamental Pears (*Pyrus* sp.) Chlorosis, High water users, Aphids, Sunscald

Mimosa (*Albizia julibrissin*) Short-lived, Borers, Seed litter, Leaf litter, Flower litter, Webworm

Russian Olive (*Elaeagnus angustifolia*) Bacterial canker, Litter, Short-lived

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TREES WORTH TRYING

Aleppo pine (*Pinus halepensis*)
Anacacho orchid tree (*Bauhinia congesta*)
Apache pine (*Pinus engelmannii*)
California fan palm *(Washingtonia filfera)*
Chir pine (*Pinus roxburghii*)
Chitalpa (*Catalpa x Chilopsis*)
Coolibah (*Eucalyptus microtheca*)
Gambel oak (*Quercus gambelii*)
Goldenrain tree (*Koelreuteria paniculata*)
Japanese black pine (*Pinus thunbergiana*)
Japanese pagoda tree (*Sophora japonica*)
Lacey oak (*Quercus glaucoides*)
Littel leaf ash (*Fraxinus greggii*)
Mediterrancean fan palm *(Chamaecrops humilis)*
Mexican fan palm *(Washingtonia robusta)*
Mt. Atlas pistache (*Pistachia atlantica*)
New Mexico locust (*Robinia neomexicana*)
Smoke tree (*Cotinus coggygria*)
White thorn acacia (*Acacia constricta*)
Windmill palm *(Chamaerops fortunei)*

RESOURCES & REFERENCES

Local Resources:
County Extension Agent
Texas Forest Service Office
Local nurseries
Garden Clubs
Native Plant Societies

Other Resources:
National Arbor Day Foundation, 211 N. 12th St. Lincoln, NE 68508.
American Forests, P.O. Box 2000, Washington, D.C. 20013-2000.

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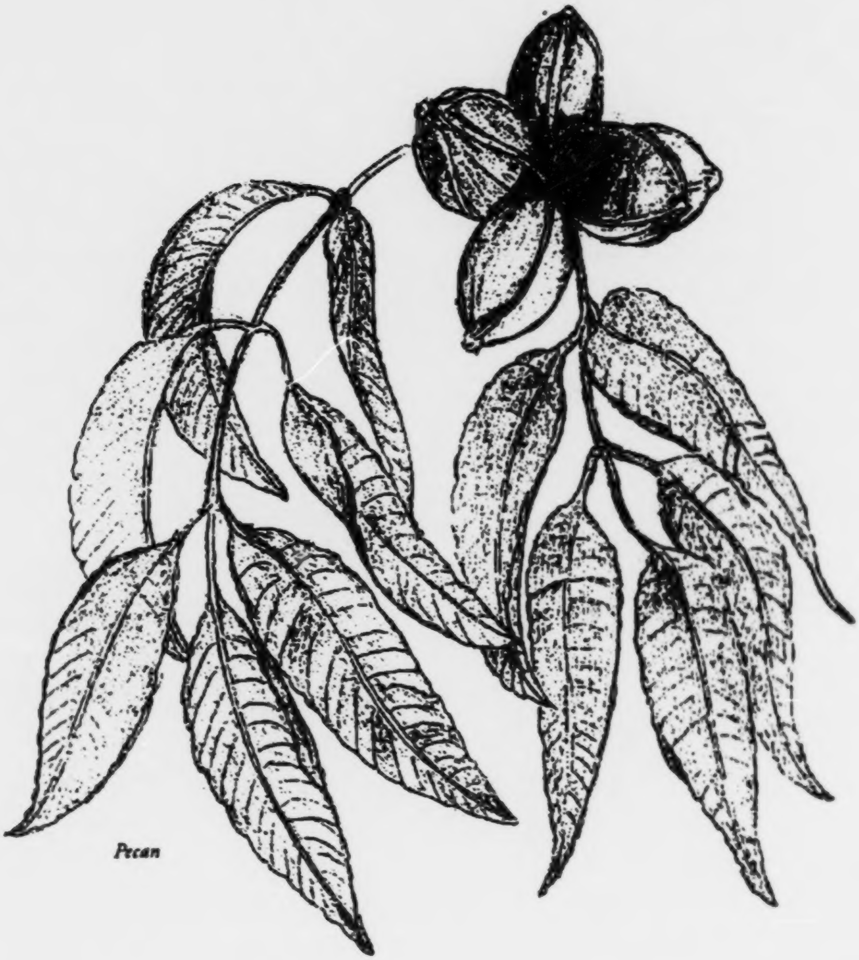
KEEP El Paso BEAUTIFUL

"The best time to plant a tree was 20 years ago.
The second best time is now." – *anonymous*



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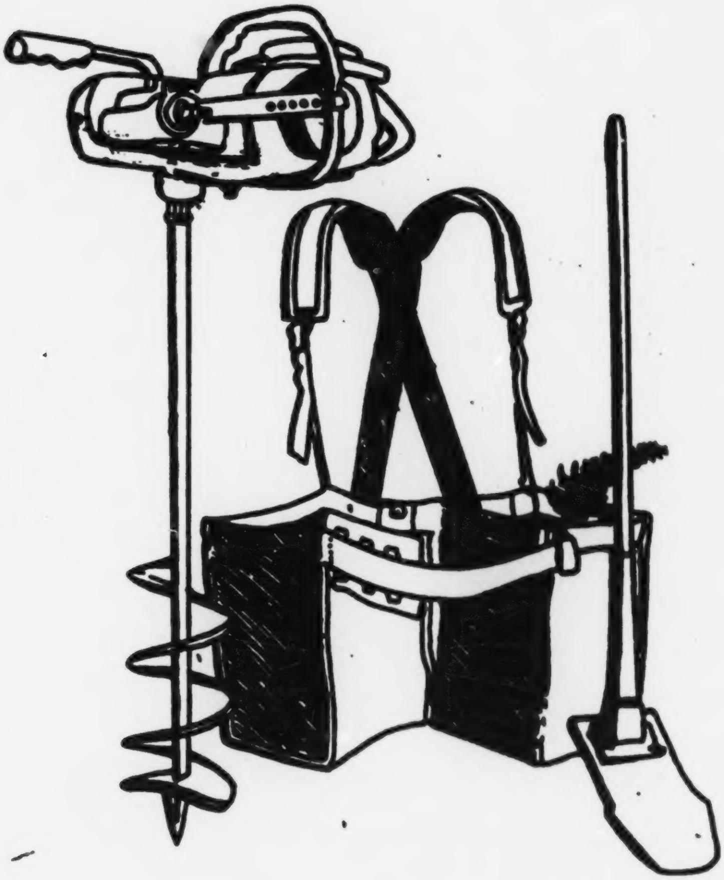

NEW MEXICO STATE UNIVERSITY

Cooperative Extension Service • Circular 526

College of Agriculture and Home Economics

Chemical trade names listed in this publication are neither warranties nor recommendations and cannot be regarded as such. The user of any pesticide chemical is responsible for proper application in strict adherence with all label directions on the pesticide container and takes full responsibility for any damage or injury caused by the pesticides suggested in this publication, whether to crop, person, or property.

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Planting and Handling Conifer Seedlings in New Mexico

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As recent as 10 years ago, conifer plantings in New Mexico had only sporadic success, with generally low survival rates. Poor survival was blamed on seedling quality or drought. However, many failures were probably caused by improper seedling care or the actual planting technique. Planting methods should provide acceptable survival at minimum establishment costs, in terms of cost per surviving tree. Close attention to the biological requirements of the planting stock and proven planting techniques will enhance survival and the long-term performance of newly planted seedlings. Survival rates of 80 to 90% are possible with proper site preparation, handling practices and planting techniques. This circular describes proper site preparation and planting techniques for bareroot and containerized conifer seedlings.

SPECIES

Many factors must be considered when choosing which species to plant on a given site. Generalized species recommendations are difficult to make and are beyond the scope of this circular. Among the criteria that should be considered to make the proper species choices are:

1. The species selected must meet management and economic objectives.
2. Species must be ecologically suited to the site.
3. Locally adapted seed sources should be planted unless information is available on introduced sources.
4. Damage potential from insects and disease should be low.

SITE PREPARATION

Site preparation is designed to optimize conditions for favorable planting, survival and seedling growth. Mechanical site preparation, combined with chemical weed control, is effective in the Southwest where temperature extremes and irregular rainfall patterns complicate planting prescriptions.

Site preparation is important for both containerized and bareroot nursery stock. The intensity of site preparation practices depends on existing soil conditions and vegetative competition. Site preparation activities should also minimize soil erosion and compaction.

Mechanical Site Preparation

The goal of mechanical site preparation is to eliminate woody plants and perennial grasses that deplete available spring soil moisture. Secondary goals are to improve soil porosity, bulk density and fertility. Increased porosity and decreased bulk density improve water movement through the soil to plant roots, enhance extensive root development and, ultimately, improve drought tolerance.

Mechanical site preparation alone usually causes rapid revegetation with grass and weeds, while reducing the woody plant component of the ecosystem. This is caused by loosening topsoil, which fosters germination of dormant seeds buried in the soil. However, changes in the other site characteristics such as improved soil moisture and quality of planting, outweigh the increase in herbaceous competition. Also, herbaceous species can be controlled with chemical weed control practices (see below). Regardless, perennial vegetation must be removed before seedlings are planted. An exception may be wildland settings where topography is severe or logging debris is left behind to provide shade for the young seedlings.

The planting site should be plowed and disked the year before planting. This loosens compacted soils in addition to improving moisture infiltration. Rocky soils may require ripping (14-18" deep) before plowing. Rototilling the following spring will prepare the ground for planting.

Chemical weed control in spring should kill emerging herbaceous plants with minimum resprouting. This eliminates competition for moisture and light during the first season of establishment. Pre-emergent herbicides generally control vegetation better and are safer for woody plants than post-emergent herbicides. Post-emergent herbicides may require repeated applications to control mature plants.

Complete season control with a single spring application is possible at higher elevations because of shorter growing seasons. Follow-up applications with post-emergent herbicides may be needed at lower elevations where the growing season extends beyond 140 days.

The choice of herbicides depends on the target species. Selected herbicides should control a minimum of three to five of the dominant weed species. When selecting appropriate rates for control, consider how soil type may effect chemical toxicity by potential changes in infiltration and persistence. The Cooperative Extension Service county agent or Soil Conservation Service can help survey existing plant competition, and select appropriate herbicides and treatment schedules. Herbicides that control competing vegetation around New Mexico conifers include Atrazine, Goal, Roundup and Velpar. *Always follow label recommendations for use and safety.* Never use a label that has not been certified for your particular use.

PRE-PLANTING CARE

In addition to proper site preparation and planting techniques, care of seedlings before planting can significantly affect establishment success.

Bareroot Seedlings

Dormant bareroot seedlings are usually lifted from the nursery in February and March. Seedlings are graded, packaged and stored in refrigerated units until shipping. Cold storage keeps the newly lifted stock dormant and provides flexibility in planting programs because planting dates can be shifted to wait for optimum soil moisture conditions for planting. Bareroot seedlings may be placed in refrigerated storage (34-36°F) for 7 to 10 days if planting is to be delayed and storage space is available.

Do not remove seedlings from the original package if bareroot seedlings are to be planted within 1 week. Open the top of the package, wet the roots and store in a cool place out of direct sunlight. Check the trees periodically to ensure the roots stay moist and are not exposed to temperature extremes (temperatures below 15° or above 60°F). Seedlings exposed to several days of warm temperatures could begin active respiration, consuming stored food reserves.

Bareroot stock that has started shoot elongation before planting will not have high survival because growing plants are more sensitive to moisture stress, and the consumption of stored food reserves reduces root growth capacity. Bareroot seedlings that cannot be planted within 1 week of receipt should be unpackaged and heeled in (figure 1).

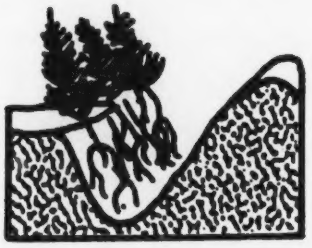
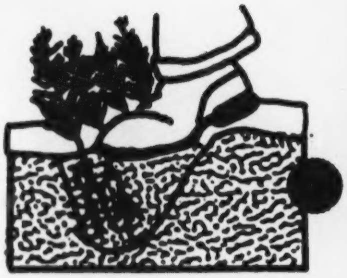


Figure 1. Heeling in.



Steps for heeling in your trees: 1) dig a U-shaped trench in a moist, shady place that is deep enough to receive the full length of the roots, 2) remove seed-lings from bundles and spread them out evenly, three or four trees thick, 3) fill in loose soil and water well and 4) finish filling the trench with soil and press down firmly.

Containerized Seedlings

Containerized conifer seedlings have become increasingly popular in the arid Southwest. A containerized seedling has a built-in protection system (the root plug) that reduces transplant stress during handling and planting. Containerized seedlings stored in a cool place, protected from direct sunlight and wind, usually can be held in open packages 3 to 4 weeks without a loss in planting stock quality. Keep the root plugs moist by adding enough water to each container to saturate the root plug once or twice a week. Plant as soon as possible.

WHEN TO PLANT

Important environmental conditions at planting are air and soil temperature, soil moisture, relative humidity and wind speed. Extremes in any one or a combination of these conditions can cause serious seedling stress and, possibly, poor survival. This is especially true if seedlings are mishandled before planting. Plants should never be planted in dry soil. Figure 2 depicts potential damage to bareroot seedlings when roots are exposed for 5 minutes to various air temperatures in combination with wind. The extent of damage is directly related to the percent of water loss from the planting during root exposure.

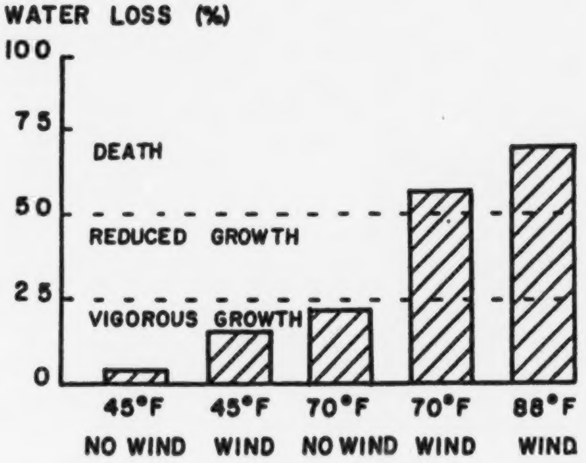


Figure 2. Five-minute exposure vs. water loss in bareroot conifers

South facing slopes should be planted first in the spring because they are the first to be free of snow and the first to dry out. North facing slopes should be planted first in the fall because they are the first to accumulate snow.

Bareroot Seedlings

Spring is the best time to plant bareroot stock at low elevations (below 5500 feet) and in mountain valleys. Summer plantings at low elevations are not recommended because of adverse environmental conditions. Summer plantings in mountain valleys are not advised because of the difficulty in coordinating planting time with the onset of summer rains. Fall plantings in mountain valleys do not provide enough establishment time before the onset of winter.

Containerized Seedlings

Spring and fall plantings with containerized stock are desirable at lower evaluation sites. Fall plantings, in particular, have resulted in excellent survival. Spring plantings with containerized stock in mountain valleys have more favorable growing environments, compared to plantings at any other time of the year. Mid-summer plantings in mountain valleys are generally acceptable if timed appropriately with the annual summer rains. However, spring plantings in mountain valleys generally yield 10 to 20% higher survival rates (depending upon the species) over mid-summer. Planting mountain valleys after August 15 is not recommended.

PLANTING TECHNIQUES

Many types of planting tools are available, e.g., shovel, hoedag, flat bar, plug bar, power auger or machine planter. Selection of a planting tool is based on size of planting, conditions of site and the availability of personnel, equipment and tools.

Machine planting usually gives better survival than hand methods, but is recommended only when soil conditions permit adequate machine packing of the soil around the seedling root system. Machine planting rates range from 600 to 1,000 trees an hour. Planting costs can be cut considerably on large projects.

One-man power augers are popular planting tools. Auger planting works best on loamy soils and sites that have been mechanically prepared. One auger can keep three or four people busy with a planting rate of 300 or 400 trees per day. Uniform packing of seedling roots is easier than with other hand planting methods because the soil is loosened when augered out of the hole.

Hand planting tools are easier and cheaper to use for small projects. Planting quality can also be improved with site preparation before planting. Planting rates per person range from 800 to 1,200 seedlings per day, depending on site conditions and planting experience. Planting procedures with hand vival.

The following statements are generalized handling and planting instructions for both bareroot and containerized seedlings.

Bareroot Seedling Handling

- Minimize seedling exposure to air (figure 1) or freezing temperatures.
- Use heavyweight canvas or insulated carrying bags for bareroot stock.
- Minimize root damage:
  - Do not count seedlings.
  - Do not shake or beat seedlings.
  - Do not strip or prune roots.
  - Do not twist or twirl lateral roots.
- Loosely stuff carrying bags.
- Cover roots with wet peat moss.
- Close partially filled shipping packages.
- Store bags in insulated trailer or shade.
- Remove only one tree at a time from planting bag.
- Plant all trees in carrying bag before break.
- Follow proper planting procedures.
- Return all unused trees to proper storage bags storage location.

Containerized Seedling Handling

- Thoroughly wet container stock 24 to 48 hours before planting.
- Minimize seedling exposure to direct sunlight; keep seedlings in shade until planted.
- Remove only one seedling at a time from its container
- Avoid freezing of root plug.
- Extracting containerized seedlings
  - Squeeze the tube between fingers to loosen the root plug from the sides of the tube. Extract seedling by pulling straight up. Do not bend root plug.
  - If the root plug cannot be extracted, cut 1/2 inch off the bottom of the tube and repeat step above.
  - If container lacks vertical rips, sever all lateral roots encircling more than 50% of the root ball.

- Avoid planting in standing water.
- Avoid planting in rocky outcrops.
- Avoid planting in duff (decomposing forest litter).
- Planting hole should be at least 1 inch deep[illegible] than the existing root system.
- Place seedling in planting hole at the depth it grew in the nursery or slightly deeper.
- Allow roots to hang naturally without turning or twisting. Do not bend tap root in "J" or "L" shape in the planting hole.
- Close hole and pack soil firmly around seedling roots to avoid air pockets.
- Use moist mineral soil to fill hole. Do not mix soil with snow, grass, sticks or rocks.
- On poor or marginal sites, a thin layer of mulch around newly planted seedlings will reduce evaporation.
- Water trees immediately after planting if possible to help settle soil and to reduce seedling moisture stress during establishment.

See appendices A through D for an illustrative review of planting techniques.

All seedlings experience some transplant shock. Typical seedling responses to transplanting are needle dieback, failure to break bud, or death. Occasionally, some species will flush foliage on the new candle while the previous year's needles die back. Good planting techniques reduce transpl[illegible] shock.

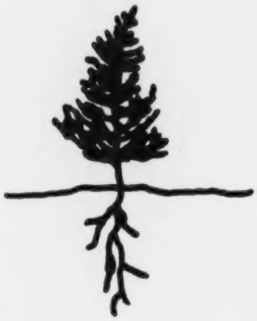
Most transplant shock, generally visible as browning of the needle tips and wilting, is not caused by poor planting stock or droughty conditions, but by poor root-to-soil contact created during planting when air gaps form at the root/soil surface. Seedling stress caused by air gaps can occur even under environmental conditions favoring low rates of transpiration. Recovery is only as fast as root regeneration and growth into moist soil can occur.

The degree and length of transplant shock depends on the type and duration of stress. A combination of severe site conditions, improper handling and poor planting techniques can lead to an extended disruption in normal plant biological functions and, possibly, death.

For additional information regarding seedling storage, handling and planting, contact the Mora Research Center or the nearest State Forestry District office (Appendix E).

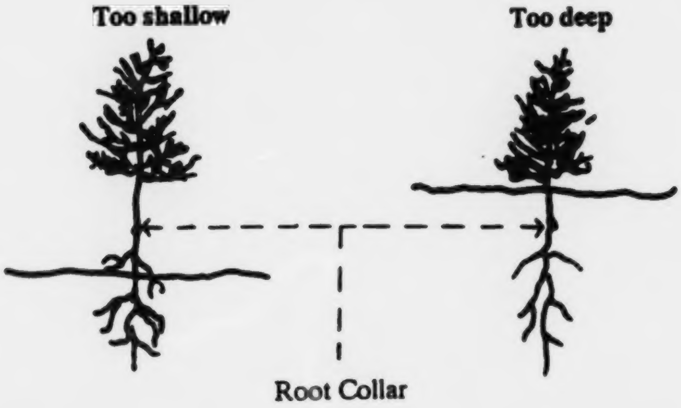
APPENDIX A

CORRECT METHOD OF SEEDLING PLANTING



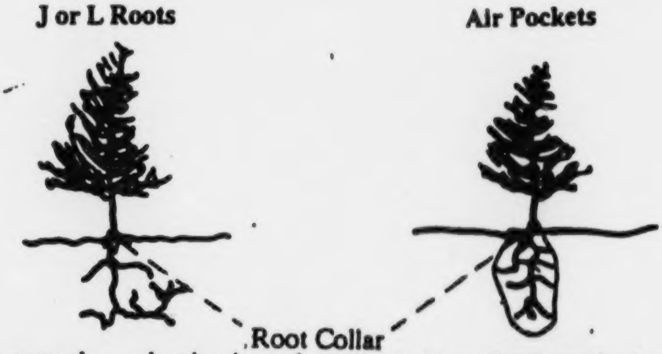
- Soil firmly packed around roots.
- No air pockets.
- Roots straight with no J or L bends.
- Root collar at or slightly below ground level.
- Root not pruned.

ERROR IN PLANTING


Too shallow
Too deep
Root Collar

- Hole not deep enough.
- Root collar and upper roots exposed.
- Roots dry out.

- Hole is too deep.
- Root collar buried.


J or L Roots
Air Pockets
Root Collar

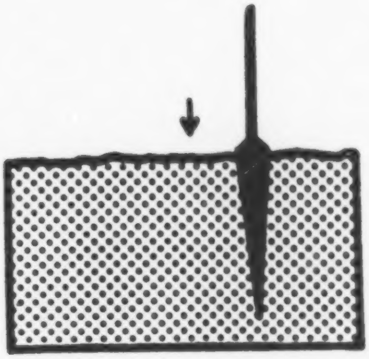
- Hole is not deep enough — planting in rocky soil.
- Roots cannot effectively take up water.
- Tree not wind-firm.

- Soil not firmly packed around roots.
- Air pocket forms.
- Roots dry out.

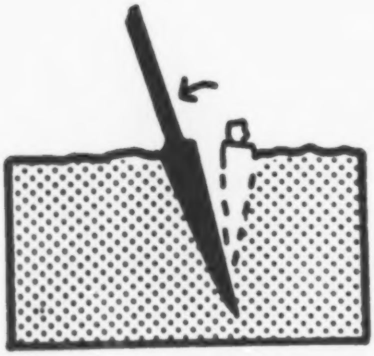
APPENDIX B

PLANTING WITH A FLAT BAR

1. Insert flat bar straight down.

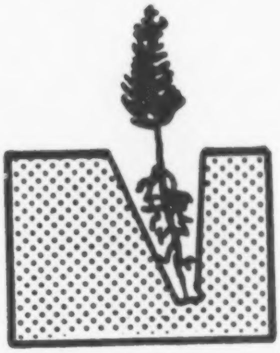


2. Pull flat bar backward to open hole.

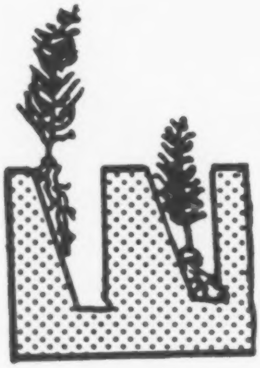


3. Remove flat bar and place seedling at correct depth with root collar at or slightly below ground level.

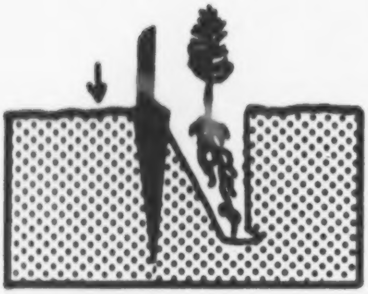
Correct



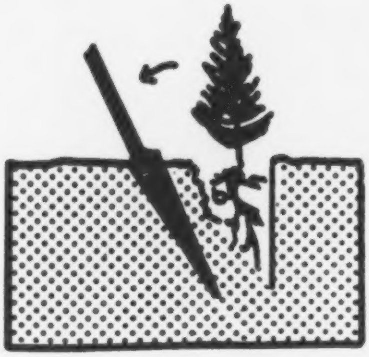
Incorrect



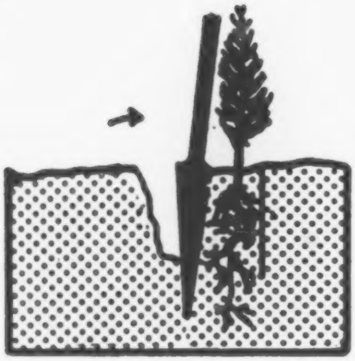
4. Insert flat bar straight down until flat bar footrest is level with ground.



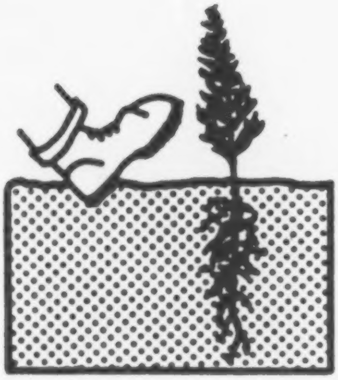
5. Pull flat bar backward to pack soil around lower part of seedling to eliminate air pockets.



6. Push flat bar forward to pack soil firmly against upper part of seedling.



7. Remove flat bar and fill in last hole by firming with heel.



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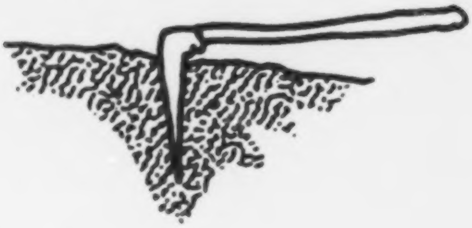
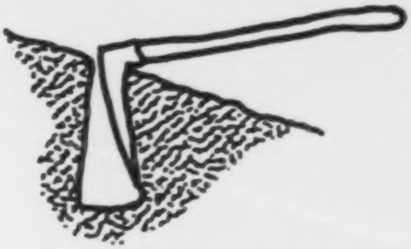
APPENDIX C

PLANTING WITH A HOE

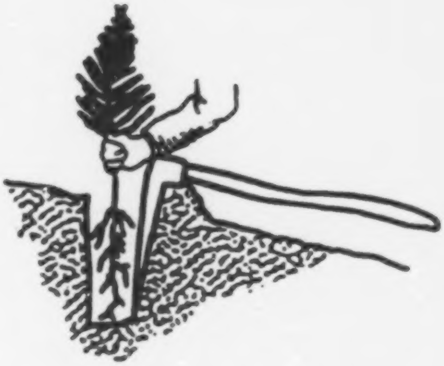
1. Swing hoe to get full penetration.



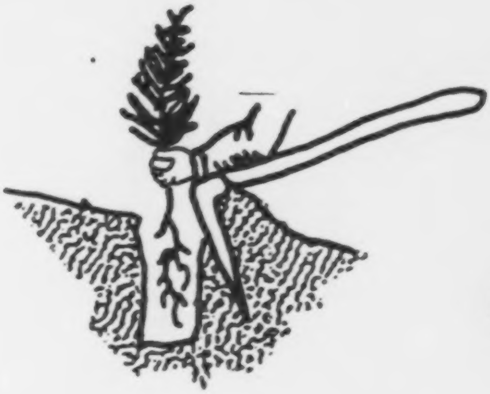
2. Lift handle and pull up to widen hole.



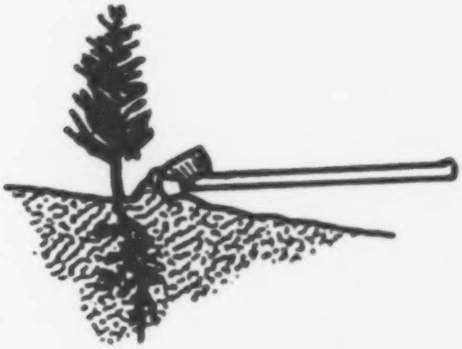
3. Place seedling while using hoe to hold back soil.



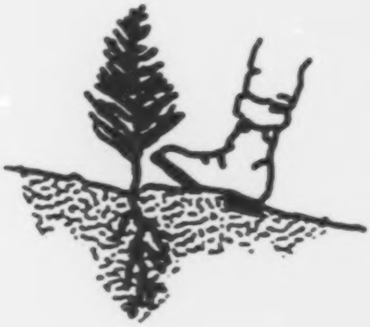
4. Use hoe to pack soil at bottom of hole.



5. Use hoe to pack soil at top hole.



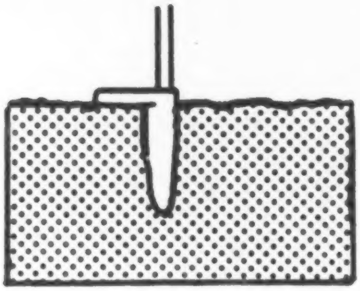
6. Firm soil around seedling with feet.



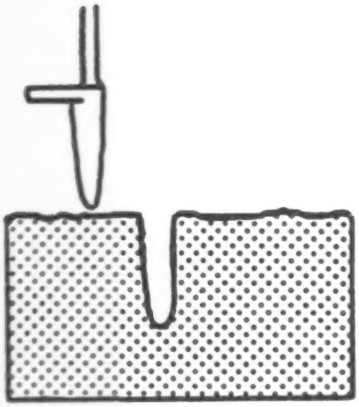
APPENDIX D

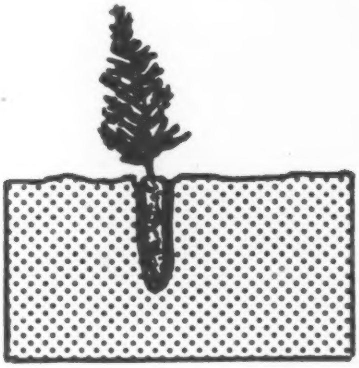
PLANTING WITH A PLUG BAR

1. Insert plug bar straight down until plug bar footrest is level with ground.

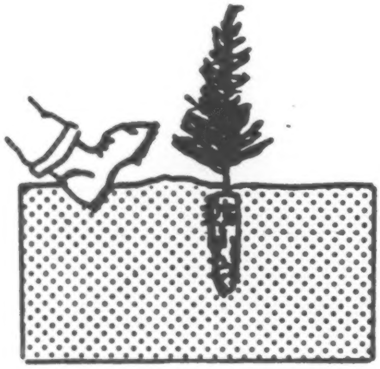


2. Remove plug bar and place seedling in hole.





3. Firm soil around seedling with heel of boot.



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Revised October 1989 Las Cruces, NM

NATIONAL WILDFLOWER RESEARCH CENTER
CLEARING HOUSE

Wildflower Meadow Gardening

So you want to create the eye-catching color and diversity of a wildflower meadow. Unfortunately, just throwing out a few seeds won't produce the desired results. Natural meadows evolve over many years, adapting to environmental conditions and developing intricate associations between plants, animals, and microorganisms. A planted wildflower meadow can rival nature and deliver low-maintenance advantages in time, but only if it's established correctly and modeled after surrounding natural plant communities. These recommendations are for establishing a wildflower meadow in an *open, sunny, well-drained area.*

Natural meadows occur in areas such as alpine slopes or prairies, where environmental factors limit the growth of woody species and halt the natural progress of plant succession. Most meadows are only a transitional stage that will be replaced by shrubs and trees, so long-term management is important in maintaining a meadow over time.

Many meadow gardeners strive for a field of wildflowers with only occasional clumps of grass. Yet grasses are an essential component of a self-sustaining, low-maintenance wildflower meadow. Learn to recognize and encourage desirable native grasses, so you can discourage the growth of aggressive non-native grasses.

Selecting the Appropriate Meadow Species

A wildflower area is a complex, interactive plant community, not just a collection of individuals. Choose a mixture of native species that, over a period of time, will naturally sort themselves out; the species best adapted to the site will be the ones that thrive after the first few years. Inventory the site and its microhabitats, such as wet, low-lying areas, shady areas, or open fields, and determine the species best suited to each condition.

When choosing wildflower species for your meadow planting, be sure to consider plant height; bloom period; whether the plant is a perennial, self-seeding annual, or a biennial; seed availability; and noxious weed potential.

You'll want to plant perennials, annuals, and biennials in your meadow, and to plant a variety of native species that will provide color throughout the growing season. Check to make sure the plants you're choosing aren't on your state's noxious weed list.

The Wildflower Center does not recommend planting wildflower seed mixes. Determining a mix's composition, both for the individual species and their relative contributions, is difficult. Mixes often contain a high percentage of species that will be planted outside their natural ranges. You're better off buying indi-vidual native wildflower seeds or making your own mix.

Grasses

Most meadow and prairie managers recommend that native grasses make up 50 to 80 percent of the meadow species. Grasses have several functions:

- to provide support and protection for tall flowers;
- to fill in spaces around wildflowers otherwise occupied by weeds;
- to add color and texture to the landscape;
- to prevent soil erosion; and,
- to provide food and cover for wildlife.

Grass growth forms are either mat-forming or bunch-forming. Mat- or sod-forming grasses spread by runners or stems that grow horizontally along the ground and put roots down. Bunch grasses grow in distinct clumps.

Many native sod grasses, such as buffalograss (Buchloe dactyloides) grow in a loose matrix that easily allows room for wildflowers. Open spaces between native bunch grasses such as bluestems (*Andropogon* spp.), grama grasses (*Bouteloua* spp.), and muhly grasses (*Muhlenbergia* spp.), offer gaps for herbaceous plant establishment.

Most non-native turf grasses, such as St. Augustine and annual rye, are too competitive to allow other plants to become established. Plus, many of those turf grasses are cool-season grasses that begin their growth in early spring, with maximum development occurring from late March to early June. They mature and produce seeds in late spring or early summer, becoming semi-dormant during the summer. Growth usually resumes during the cool months of fall.

Warm-season grasses resume their growth in late spring and continue to grow until early fall, producing

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most of their foliage in midsummer. Competition with warm-season grasses shouldn't be a problem for northern wildflowers.

Soil Preparation

If you select plants appropriate to the microhabitats on your site, they should grow well, without soil improvements, once they're established. Disturbing the soil, in fact, can create more problems than it solves. If your site has been disturbed or the original topsoil removed, some soil amendments can help.

Properly prepared soil helps conserve water because it absorbs and holds water more efficiently and drains better. Healthy soils support healthy plants that can better resist pests and pathogens. If the soil is clay or sand, you may need to improve its content by adding organic matter such as compost. Prepare your beds two to three months before planting so the soil can settle. Apply a four- to six-inch deep mulch to control weeds.

Some plants will benefit from additional soil preparation. Many wildflowers require well-drained soil, so you may need to supplement the prepared soil with sand, gravel, or other material that loosens it and permits good drainage. Some wildflower species require moist soil; add large amounts of rotted leaves and peat moss to accommodate those needs. Other wildflowers develop weak, spindly stems if they're planted in rich soil, so they'll fare better in a poor soil with high mineral content.

Identify the plants already on your site and decide whether you want them. If you have a lot of weeds, you may need a year or more to kill them all, although killing them may not be feasible if the site is extremely disturbed. Eliminating weeds as much as possible before planting is easier and less expensive than trying to control them in a newly seeded site.

If the site isn't too weedy and you're going to interseed wildflowers into the existing vegetation, the process is relatively easy. Mow the vegetation as short as possible and rake up the thatch. Try to open up some bare areas to allow the seeds to make soil contact.

If you want to plant wildflowers on a clean site, you can repeat an initial light tilling and watering cycle (till no deeper than one inch), or apply an herbicide treatment as many times as needed to clear the site. How many times you need to repeat the process depends on the plot size, existing weed competition problems, and the degree of weed control you desire. The seeds, roots, and rhizomes of weeds frequently lie dormant beneath the soil surface and germinate quickly after they are exposed to moisture and light. The less disturbance there is, the easier it will be to control weeds.

If you prefer not to till or hand-weed, two applications of a non-residual, post-emergent herbicide such as Roundup may remove existing vegetation. Before you apply the herbicide, water the site for a week or two to promote germination of weed seeds. Let the seedlings grow for one or two weeks, and apply the herbicide. Repeat this process once more to ensure a fairly clean seed bed. Because it is non-residual, Roundup does no continue its herbicidal activity. You can plant your wildflower and native grass seeds as soon as you are sure competing vegetation is under control. Roundup will not affect seed germination, only the growing plants that you have treated.

When to Plant

When you should plant depends on where you live and what you're planting. Fall is the best time to plant many native species. Some seeds need a chilling period (cold stratification) to break their dormancy, while others have hard seed coats that need to be worn down or scarified before they can germinate. Sowing seeds in the fall often provides the conditions necessary to break seed dormancy. Warm, wet spring weather then induces the seeds to germinate.

In the Midwest, most native wildflowers and grasses are perennials. Although native seeds can be planted in the spring or fall, spring planting is most common. When to plant is hard to predict because of the variability of snow melt and spring showers. You can plant warm-season prairie species any time from mid-spring through June.

Seed in thr fall late in the season after frost as a dormant planting. Broadcast or drill the seeds, but remember they won't germinate until spring. During the winter, the seeds will undergo stratification, breaking dormancy.

Ideally, native seeds would be planted following nature's seeding schedule. Since this is logistically impossible for plantings of any size or diversity, select an optimal season. Knowing more about when wildflowers bloom naturally in your area and when the rainy season occurs will help you figure out the time periods and conditions necessary for seed formation and germination.

Seeding Methods

One rule applies to *all* plantings: the seeds must be in good contact with the soil. Soil contact helps the seeds retain moisture, which is necessary for germination, and provides a substrate for seedling growth.

An adjustable, hand-carried mechanical seeder is effective for many plant species. Mixing seeds with fine, damp sand and then distributing the seed-sand mixture should eliminate clumping. Seed into the prepared area, then rake or tamp seeds into the soil to ensure good seed-soil contact.

Spreading a wildflower mix evenly is difficult because of the different sizes and weights of seeds. Purchasing the seeds for each species separately and seeding one species at a time can eliminate this problem.

Hand-broadcasting is the simplest method and it works if you do it correctly. For better seed distribution, mix the seeds with fine, damp sand, in a proportion of four parts sand to one part seeds. Seed into the prepared area, then rake or tamp the seeds into the soil to ensure good seed-to-soil contact.

For more immediate results, you may want to use a combination of seeding and planting container-grown wildflowers. Adding container-grown plants is especially convenient when planting slower-growing perennials and can be fairly economical if you're only planting a small area.

Remember: All plants require water to germinate. If rain doesn't fall within a couple of days after planting, try to water the area thoroughly at least once, if possible.

Managing Your Site After Planting

How you manage your wildflower area depends on the look you want to achieve. Individual species have different management needs and may require a combination of techniques; the amount or degree of maintenance will vary from year to year.

The First Year

Annual species germinate quickly and visually dominate a site during the first year. Although many perennials germinate the first year, their root growth comprises two to three times the amount of the aboveground vegetation, and they normally don't flower until the second or third year. Native bunch grasses usually don't flower or set seeds the first year, and depending on the species, they reach heights of only two or three inches by the end of the growing season. Under favorable environmental conditions, little bluestem (*Schizachyrium scoparium*) develops a two- to three-inch primary root system before any aboveground shoots appear.

If tall annual weeds are shading the wildflower seedlings, mow at a height set higher than the seedlings. A scythe, hand clipper, or weed cutter will do the job if you don't have a mower, or if the blades can't be set high enough to miss the seedlings. Because most of the weeds will be annuals, mowing them before they set seeds helps destroy the next season's seed crop. The exact time and height for mowing varies with each site and the species planted. In many cases, you can't avoid hand-weeding or spot applications of an herbicide, especially if aggressive species or perennial weeds dominate the site.

Annual and biennial wildflowers must be allowed to re-seed to produce a strong stand the next year. Once your meadow wildflowers have bloomed, delay mowing the area until at least half of the late-blooming species have dropped seeds. If your meadow has tall, warm-season native grasses, wait until late summer or early fall to mow, allowing them to elongate, flower, and set seeds. Never mow mid- to tallgrasses below six inches. Although you can mow the grasses in late fall when they are dormant, you may want to leave them intact until late winter or early spring to provide food and cover for wildlife, and add texture to an otherwise barren winter landscape.

When you mow your meadow, leave the clippings—which may have viable seeds—in place. To increase the diversity in a moist meadow, however, you must remove the clippings. Remove the clippings of any weedy or undesirable species that may have set seed.

The Second Year

With well-spaced and abundant rainfall, most native bunch grasses will flower and produce seeds by the second year. Some biennial and perennial wildflowers will begin to bloom. If optimum conditions didn't occur the first year, residual seeds from the previous year may germinate.

As your wildflower meadow fills out, you may choose to re-seed or spot-transplant species to fill in bare spots or increase species diversity, especially the second or third year after seeding.

If annual weeds continue to be a problem, you'll need to remove them before they set seed. The need to weed should taper off as wildflowers and native grasses become more established.

The Third Year and Beyond

By the third or fourth year, your wildflower area may benefit from a controlled burn if enough fuel has accumulated. Fire is a natural process in many ecosystems and can reduce woody plants and other invasive species. Burning also stimulates the growth of many native grasses and prairie perennials, and breaks the dormancy of some seeds.

Remember that burning is a technique that requires special expertise and should not be attempted without first consulting experienced experts! Fire is a tool that can enhance or inhibit a species, depending on your goal. The target species isn't the only one that will be affected. When and how you burn depends on what you want to achieve.

Many areas require permits for burning. In addition, urban areas often have regulations prohibiting prescribed burns. If you can't burn your meadow, you can continue to control weed invasions and remove excess thatch by mowing or spot-treating with an herbicide.

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NATIONAL WILDFLOWER RESEARCH CENTER

CLEARING HOUSE

Wildlife Gardening Bibliography

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Butterfly Gardening Resources

Butterfly gardening is an "environment friendly" approach to landscaping, using locally adapted native plants and non-toxic alternatives to pesticides. Butterflies are attracted to flowers of all shapes, sizes, colors and fragrances. They usually prefer flowers with yellow, blue, purple, and occasionally red blossoms. Flowers with flat surfaces, clustered florets, or large-lipped petals provide the best conditions for perching, and a greater density of flower heads attracts more butterflies than single flowers. Most butterflies frequent open, sunny areas that are protected from the wind. A combination of native wildflowers, shrubs, trees and grasses that bloom from early spring through late summer will keep butterflies well-fed throughout the seasons. Resources available for studying or gardening for butterflies include:

Butterfly Identification Guides

Christensen, J.R. 1981. A Field Guide to the Butterflies of the Pacific Northwest. Moscow, Idaho: University Press of Idaho.

Covell, C.V., Jr. 1981. A Field Guide to the Moths of Eastern North America. Boston: Houghton Mifflin.

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Garth, J.S. and J.W. Tilden. 1986. California Butterflies. Berkeley: University of California Press.

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Tekulsky, M. 1985. *The Butterfly Garden*. Boston: The Harvard Common Press.

Xerces Society and The Smithsonian Institution. 1990. *Butterfly Gardening: Creating Summer Magic in Your Garden*. San Francisco: Sierra Club Books.

Organizations

Butterfly Lovers International
210 Columbus Avenue
San Francisco, Calif. 94133

Southern Lepidopterists' Society
Thomas Neal, Secretary-Treasurer
3820 NW 16th Place
Gainesville, Fla. 32605

The Lepidoptera Research Foundation
c/o Santa Barbara Museum of Natural History
2559 Puesta Del Sol Road
Santa Barbara, Calif. 93105

The Xerces Society
The International Organization for Invertebrate Habitat Conservation
10 Southwest Ash Street
Portland, Ore. 97204

Utah Lepidopterists' Society
c/o Col. Clyde Gillette
3419 El Serrito Drive
Salt Lake City, UT 84109

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RECOMMENDED SPECIES

FOR NEW MEXICO

Botanical name	Common name	Site preference
WILDFLOWERS		
Abronia sp.	Sand verbena	Sandy dunes
Achillea millefolium	Yarrow	Variety of soils, sun to part sun
Agave Parryi	Century plant	Deserts, well-drained soil
Aquilegia caerulea	Rocky mt. columbine	Mesas, mountains
Artemisia frigida	Fringed sagebrush	Mesas, mountains
Asclepias tuberosa	Butterfly weed	Meadows; needs moisture while flowering
Baileya multiradiata	Desert marigold	Well-drained, sandy, gravelly soils
Berlandiera lyrata	Chocolate flower	Dry, rocky soils; desert, mesa
Castilleja confusa	Indian paintbrush	Mountain pine forest
C. integra	Indian paintbrush	Gravelly soil on hills and plains
Dalea scoparia	Broom dalea	Desert, mesa
Erigeron divergens	Branching fleabane	Desert, mesa, or mountain
Gaillardia aristata	Blanketflower	Mesa or mountain
G. pulchella	Indian blanket	Mesa; sandy soil
Ipomoea leptophylla	Bush morning glory	Sandy to sandy loam, lower elevations
Ipomopsis aggregata	Skyrocket gilia	Mesa, mountain, open forest
I. longiflora	Blue gilia	Desert, mesa
Iris missouriensis	Rocky mountain iris	Mountain, wet meadows
Liatris punctata	Gayfeather	Open plains, well-drained sites
Linum Lewisii	Blue flax	Mesa, mountain
Machaeranthera bigelovii	Purple aster	Mesa
M. tanacetifolia	Tahoka daisy	Sandy soils, sun
Melampodium leucanthum	Blackfoot daisy	Dry, rocky, calcareous soil
Mirabilis multiflora	Wild four o'clock	Open, sandy areas, desert grasslands
Monarda citriodora	Horsemint	Well-drained, sandy loam to rocky soils
Oenothera caespitosa	White primrose	Roadsides, dry, rocky slopes
O. berlandieri	Mexican primrose	Desert
O. hookeri	Yellow primrose	Moist areas in mountains
O. missouriensis	Missouri primrose	Roadsides, dry, rocky slopes
O. pallida	Pale evening primrose	Sandy, open or disturbed mt. areas
O. speciosa	Pink evening primrose	Open areas in a variety of soils
Penstemon alpinus	Blue penstemon	Sandy, rocky soil, mesa and mountains
P. ambiguus	Sand penstemon	Mesas and grasslands, well-drained sites
P. angustifolius	Whorled penstemon	Mesas and sandy grasslands
P. barbatus	Red penstemon	Mesa, mountain
P. Cobaea	Cobaea penstemon	Mesa and grasslands
P. Jamesii	James' penstemon	Mesa, mountain
P. pseudospectabilis	Desert beard-tongue	Deserts
P. strictus	Rocky mt. penstemon	Mesa, mountain
P. thurberi	Sand penstemon	Mesa, open sandy or stony slopes
Petalostemum purpureum	Purple prairie-clover	Desert, mesa, or mountain
Phlox nana	Santa Fe phlox	Desert or mesa
Potentilla anserina	Silver cinquefoil	Moist loam, wet meadows in mountains

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Psilostrophe cooperi	Paperflower	Desert, mesa
Ratibida columnaris	Mexican hat	Open fields, roadsides, calcareous soil
Rudbeckia hirta	Black-eyed Susan	Variety of soils
Sphaeralcea coccinea	Globemallow	Desert, mesa
Verbena bipinnatifida	Fern verbena	Sandy to gravelly soils
Zinnia grandiflora	Rocky Mt. zinnia	Dry, calcareous soil, dry slopes, mesas

SHRUBS

Acacia constricta	Mescat acacia	Dry, sandy or limestone soil
Amelanchier alnifolia	Serviceberry	Northern mountains
A. utahensis	Serviceberry	Mesa, mountain
Artemisia tridentata	Big sagebrush	Rangeland, deep, well-drained soil
Atriplex canescens	Fourwing saltbush	Dry slopes, washes and salt flats
Caesalpinia Gilliesii	Bird of Paradise	Well-drained soils, sun
Ceratoides lanata	Winterfat	Well-drained, alkaline soils
Cercocarpus montanus	Mountain mahogany	Well-drained, rocky sites, mountains
Chamaebatiaria millefolium	Fernbush	Well-drained, gravelly slopes
Chrysothamnus nauseosus	Rubber rabbitbrush	Dry, open grasslands, alkaline soil
Cowania mexicana	Cliffrose	Dry slopes of mesas
Dalea scoparia	Broom dalea	Sandy soil, sand hills and bottomlands
Dasylirion Wheeleri	Sotol yucca	Desert
Ephedra nevadensis	Mormon tea	Desert, sandy places or rocky slopes
Fallugia paradoxa	Apache plume	Dry, gravelly or sandy soil
Fendlera rupicola	Cliff fendlerbush	Desert, mesa, mountain
Forestiera pubescens	Elbow-bush	Mesa, moist valleys
Fouquieria splendens	Ocotillo	Deserts
Garrya Wrightii	Wright's catclaw	Pinon-juniper zone (5,000-8,000 ft)
Hesperaloe parviflora	Red yucca	Well-drained soil, sun
Larrea tridentata	Creosote bush	Hilly, gravelly terrain
Leucophyllum frutescens	Texas sage	Well-drained, rocky soil
Mahonia repens	Creeping mahonia	Mountain, low, creeping shrub
Nolina erumpens	Beargrass	Rocky, well-drained slopes
N. microcarpa	Beargrass	Rocky, well-drained slopes
Opuntia imbricata	Cholla	Mesa, sandy and gravelly soils
Parthenium incanum	Mariola	Gravelly caliche, grows in harsh sites
Potentilla fruticosa	Shrubby cinquefoil	Open, high mountain meadows
Ribes aureum	Golden currant	Hillsides, river valleys,
Rhus microphylla	Littleleaf sumac	Open grasslands, sandy- sandy loam
R. trilobata	Skunkbush sumac	Rocky hillsides, open bottomlands
Salvia Greggii	Autumn sage	Well-drained soils, rocky slopes
Tecoma stans	Yellow bell	Rocky areas; dies back
Xanthocephalum Sarothrae	Broom snakeweed	Open calcareous soils, mesa
Yucca glauca	Yucca	Well-drained soil, desert and mesa

SMALL TREES

Chilopsis linearis	Desert Willow	Desert, mesa
Fraxinus Greggii	Littleleaf ash	Bluffs, talus slopes, rocky hills
Prunus virginiana var. melanocarpa	Black Chokecherry	Mesa, mountain, coniferous forest
Quercus turbinella	Shrub live oak	Dry, gravelly slopes
Robinia neomexicana	New Mexico locust	Desert, mesa
Ungnadia speciosa	Mexican buckeye	Rocky areas in canyons and ridges
Yucca elata	Soaptree yucca	Well-drained soil, desert and mesa
Y. Torreyi	Torrey yucca	Well-drained soil, desert and mesa

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SHADE TREES

Fraxinus velutina	Arizona ash	Canyons, along streams
Juglans major	Arizona walnut	Along streams, southwest NM
Platanus Wrightii	Sycamore	Along streams & lakes, moist canyons
Populus fremontii	Cottonwood	Along streams, near groundwater
P. tremuloides	Quaking aspen	Mountains, sandy to gravelly soil
Prosopis glandulosa	Mesquite	Desert, along streams and arroyos
Quercus Gambelii	Gambel's oak	Mountains and mesas
Sapindus Saponaria var. Drummondii	Soapberry	Edge of woods, along streams

CONIFERS

Juniperus scopulorum	Rocky mtn. juniper	Moist sites in mountains
Pinus edulis	Pinon pine	Mountains and mesas
P. ponderosa	Ponderosa pine	Mountains
Psuedotsuga Menziesii	Douglas fir	Mountains

VINES

Clematis ligusticifolia	Virgins bower	Wet locations, roadsides, canyons
Parthenocissus inserta	Thicket creeper	Moist canyons, streambanks, roadsides

GRASSES

Agropyron Smithii	Western wheatgrass	Moist clay to clay-loam soils
Bouteloua curtipendula	Sideoats grama	Loose, limey soils
B. gracilis	Blue grama	Most soils, including alkali
Buchloe dactyloides	Buffalograss	Prairies, heavier soils
Hilaria Jamesii	Galleta	Dry, rocky ledges and slopes
Oryzopsis hymenoides	Indian ricegrass	Sandy or rocky soil
Schizachyrium scoparium	Little bluestem	Open woods and rocky grasslands
Sporobolus airoides	Alkali sacaton	Dry sandy or gravelly slopes, saline flats
S. cryptandrus	Sand dropseed	Sandy soil

NOTE: It is an important responsibility as gardeners and conservationists to seek out nurseries who propagate their own plants or purchase nursery-propagated plant materials. As consumers we need to be informed and avoid purchasing wild-collected plants. With native plants diminishing in number, it is ecologically detrimental to dig up wild plants unless the area is to be developed. It is best to either collect seeds from wild plants or to purchase seeds (or plants grown from wild seeds) from commercial nurseries.
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SOURCES OF NATIVE PLANTS AND SEEDS

Prepared by the Native Plant Society of New Mexico
P.O. Box 5017
Santa Fe, NM 87502
October, 1993

Agua Fria Nursery
1408 Agua Fria St.
Santa Fe, NM 87501
(505)-983-4831
Native and other plants,
Penstemons; catalog

Applewood Seed Co.
5380 Vivian Street
Arvada, CO 80002
(303) 431-7333
Wildflower seeds, Carpet
Wholesale catalog

Bar V 3 Enterprises
P.O. Box 306
Alamogordo, NM 88311
(505) 434-5210
Desert willow, native and
drought tolerant plants

Bernardo Beach Native Plants
520 Montano, N.W.
Albuquerque, NM 87107
(505) 345-6248
Native and adaptive plants,
design; no mail order

Colorado Alpines, Inc.
P.O. Box 2708
Avon, Colorado, 81620
(303) 949-6464
Rocky Mtn. natives; seeds,
mixes, plants, catalog

Curtis and Curtis, Inc.
Star Route, Box 8A
Clovis, NM 88101
(505) 762-4759
Seeds for reclamation, grasses,
shrubs, wildflowers; catalog

Desert Floralscapes
105 Lindbergh
El Paso, TX 79936
(915) 584-0433
Native plants

Desert Moon Nursery
Ted and Candy Hodoba
Box 600
Veguita, NM 87062
(505) 864-0614
Yucca, agave, other plants

Edge of the Rockies
133 Hunna Rd.
Bayfield, CO 81122
(no telephone)
Mountain natives and seeds,
mixes; catalog

Gunsight Mtn. Ranch & Nursery
Williams Creek Rd., Box 86
Tarpley, TX 78883
(210) 562-3225
Container grown natives;
retail, wholesale, design

Mesa Gardens
P.O. Box 72
Belen, NM 87002
(505) 864-3131
Cactus and succulents, plants,
seeds; catalog

Nature's Way Wholesale Nursery
8905 Edith Blvd., N.E.
Albuquerque, NM 87113
(505) 898-9258
Wholesale only; natives,
groundcovers, xeriscape

New Mexico Cactus Research
P.O. Box 787
Belen, NM 87002
Cactus and succulents

Pearson's Tree Place
P.O. Box 1175
Canutillo, TX 79835
(915) 877-3808
Native trees, shrubs

Plants of the Southwest
Rt. 6, Box 11A
Agua Fria near Siler
Santa Fe, NM 87501
(505) 438-8888
Plants and seeds; catalog

Rocky Mountain Rare Plants
P.O. Box 200483
Denver, CO 80220
(no telephone)
Seeds of cushion, xeric plants;
catalog; sales from Nov.- March

Rowland Nursery
540 Telshor Blvd.
Las Cruces, NM 88001
(505) 522-4227
Native trees, shrubs, plants

Santa Ana Pueblo Native
Plant Nursery
Hwy 44 & Jemez Dam Rd.
Bernalillo, NM 87004
(505) 867-1322
Native perennials and shrubs

Santa Fe Greenhouses
2904 Rufina St.
Santa Fe, NM 87501
(505) 473-2700
Native plants, seeds, cacti and
succulents from seed, Penstemons

Seeds Trust
High Altitude Gardens
P.O.B. 1048
Hailey, Idaho 83333
(208) 788-4363
Veg., flowers, grasses; catalogs

Sierra Vista Growers
P.O. Box 225
Chamberino, NM 88027
(505) 874-2415
Native trees, shrubs, plants

Southwestern Native Seeds
Box 50503
Tucson, AZ 85703
(no telephone)
Seeds only; western natives;
extensive, informative list

Wildland and Native Seed
Foundation
2402 Hoffman Drive, N.E.
Albuquerque, NM 87110
(no telephone)
Wholesale only, seeds

Wildroot Horticultural
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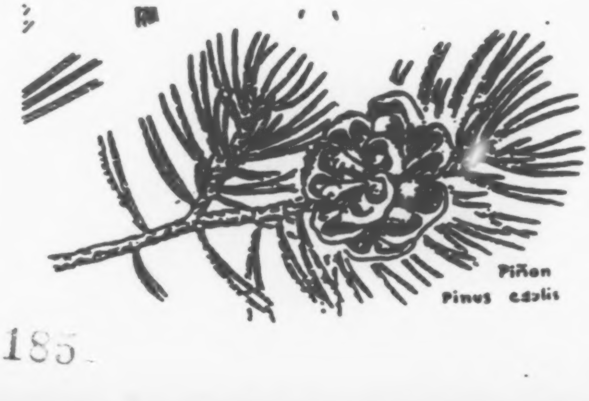

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Urban Wildlife Resources is pleased to offer the following fine books that focus on wildlife and habitat in the metropolitan environment.

Urban Wildlife Habitats: A Landscape Perspective, by L. W. Adams. This book reviews the impact of urban and suburban growth on natural plant and animal communities and reveals how, with appropriate landscape planning and management, urban areas can be made more accommodating for a wide diversity of species. The book is written primarily for persons who are interested in furthering their understanding of wildlife ecology and management in the metropolitan environment. 1994, 6 x 9, paper, 186pp. ($16.95)

Habitat Conservation Planning: Endangered Species and Urban Growth, by Timothy Beatley. This book examines the use of habitat conservation plans (HCPs) as a tool to resolve land-use conflicts. It includes case studies of nine HCPs in four states where increasing populations and biological diversity have triggered many conflicts. 1994, 6 x 9-1/4, paper, 234pp. ($17.95)

The Natural Habitat Garden, by Ken Druse. This book shows gardeners how to create beautiful, native plant gardens. Covers grasslands, drylands, wetlands, and woodlands. 1994, 8-1/2 x 11, hardcover, 248pp. ($40.00)

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The Xeriscape Flower Gardener: A Waterwise Guide for the Rocky Mountain Region, by Jim Knopf. Written by a landscape architect, this book covers planning and design, building, maintenance, estimating cost and water savings, and wildlife and pests in the garden, as well as plant lists, profiles and bloom sequences. 1991, 7-1/4 x 9-1/2, paper, 182pp. ($14.95)

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When Nature Heals: The Greening of Rocky Mountain Arsenal, by Chris Madson (text) and Wendy Shattil and Bob Rozinski (photographs). This book—through text and photographs—details the apparent irony of a diverse wildlife population on this former military-industrial site, now a national wildlife refuge on the outskirts of Denver. 1990, 8-1/4 x 10-1/2, paper, 80pp. ($14.95)

Close to Home: Colorado's Urban Wildlife, edited by Frederick R. Rinehart and Elizabeth A. Webb (text) and Wendy Shattil and Robert Rozinski (photographs). This book—through 11 essays and excellent photographs—presents a portrait of Colorado's Front Range cities from the point of view of nature. 1990, 8-1/2 x 11, hardcover, 179pp. ($19.95)

Colorado's Backyard Wildlife: A Natural History, Ecology, & Action Guide to Front Range Urban Wildlife, by Carol Ann Moorhead. This guidebook is designed particularly for children at the 6th through 9th grade level, but is adaptable to other audiences as well. 1992, 5-1/2 x 8-1/2, paper, 133pp. ($10.95)

Pocket Guide to the Humane Control of Wildlife in Cities & Towns, edited by Guy R. Hodge. Presents a collection of nonlethal approaches to urban wildlife-damage control. 1990, 4-1/4 x 7-1/2, paper, 112pp. ($6.95)

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Noah's Garden: Restoring the Ecology of Our Own Back Yards, by Sara Stein. This is the personal account of one gardener's "re-education" and her success with techniques from planting natives to restoring woodland areas. 1993, 5-1/2 x 8-1/4, paper, 294pp. ($10.95)

Attracting Birds to Southern Gardens, by Thomas Pope, Neil Odenwald, and Charles Fryling, Jr. This book includes descriptions of the 69 most common songbirds in the South and the 160 best regionally adapted plants for providing food and cover. 1993, 164pp. ($24.95)

Redesigning the American Lawn: A Search for Environmental Harmony, by F. Herbert Bormann, Diana Balmori, and Gordon Geballe. Twenty million acres of U.S. ground are devoted to the lawn. This book discusses the ecological costs of lawns. Strategies for low-impact lawns are presented--"freedom lawns," ground covers, new landscape designs and other ideas, plus ways to maintain the traditional lawn in a more ecologically sound manner. 1993, 5-1/2 x 8-1/4, paper, 166pp. ($11.00)

Gardening with Native Plants of the South, by Sally Wasowski with Andy Wasowski. Contains an extensive plant dictionary of grasses, vines, trees, shrubs and flowers. Full descriptions of each plant's characteristics are included, with information on specific ranges in the South, propagation and wildlife potential. 1994, 200pp. ($29.95)

Birdscaping Your Garden: A Practical Guide to Backyard Birds & the Plants that Attract Them, by George Adams. The lifestyles of 64 "backyard" birds, from hummingbirds to the black-tailed gnatcatcher, are highlighted. Tips for planting and cultivating the trees and shrubs necessary for these birds are included. 1994, hardcover, 208pp. ($29.95)

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is pleased to announce

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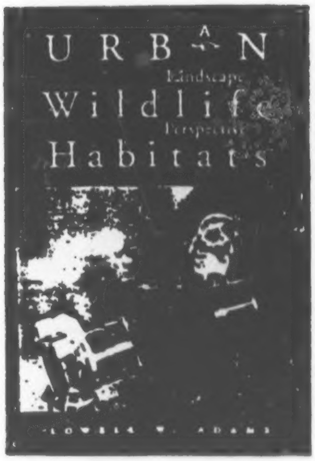
In this book, published by the University of Minnesota Press in 1994, Lowell W. Adams reviews the impact of urban and suburban growth on natural plant and animal communities and reveals how, with appropriate landscape planning and urban development, cities and towns can be made more accommodating for a wide diversity of species, including our own.



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Permaculture: *Design for Living*

by Thomas Mack

Sol y Sombra is recognized for its demonstration of earth restoration strategies and ecological design concepts based on a land use planning system known as Permaculture.

Thomas Mack, who has studied and taught Permaculture in the United States, Australia, Scandinavia, Europe, and Africa has recently joined the Sol y Sombra Foundation as the Director of Research and Permaculture Program Development. Thomas is developing the Foundation's consulting and teaching programs.

Permaculture is becoming widely known throughout the world as a system of ecological design for healthy and sustainable human habitat. More than organic gardening, more than landscape architecture, permaculture is about design for living. As a holistic system of land use planning and management, permaculture design addresses the interrelated components of total living systems: structures, technologies, energy, plants and animals, and human patterns, or "invisible structures," including social, legal, and economic systems.

With demonstration projects in over 70 countries, permaculture has become a worldwide, grassroots earth restoration program. It is at the forefront of an emerging field of restoration ecology, moving beyond environmental preservation to restoration and regeneration of living systems.

Permaculture design for ecological land use planning has the following objectives: Conservation of resources, which includes biological and mineral resources, water, energy, labor, money, human and cultural resources; Restoration of land, which includes water management, erosion control, reforestation, soil building, animal and plant integration, and repopulation of species; and Regeneration of living systems, which means the conversion of pollution and waste to energy and the establishment of self-perpetuating life support systems.

Design Methodology

Permaculture is about working with nature. We use principles of natural systems to create habitat for plants, domestic and wild animals, and people. The prime objective is to bring these into ecological harmony. Permaculture design can be applied in any bioregion. The design may be complex or simple. Whether in backyards, land reclamation, village design, or city planning, permaculture has much to offer.

Careful observation is the foundation of permaculture design. We begin by "reading" the chosen site's natural patterns, topography, watercourses, wind vectors, solar orientation, vegetative zones, animal influences, and natural boundaries.

Next, the designer creates a series of overlay maps which indicate design features in what is termed a Zone and Sector grid. Zones are determined by priority and frequency of use. Sectors indicate the flows of energy through the property. These include wind, water, solar intensity, and temperature gradients. Frost pockets and fire corridors are also noted. Based on this grid, decisions are made in terms of final design elements.

Connections between the design elements are of utmost importance. Two rules of thumb are: 1) every element must serve two or more functions; and 2) each element must be supported by several *other* elements. In this way the dynamic synergy central to permaculture is served. Self-regulation and sustainability are insured.

A thorough conceptual design, including a comprehensive species list, then serves as the basis for determining what skills and resources must be accessed. From there, detailed drawings may be made. The designer works with client and contractors to develop estimates of materials, time, labor, and other costs.

Ecologically Responsive Structures

Permaculture seeks to balance aesthetics with functional efficiency on the ground and in buildings. Like living organisms, buildings breathe, receive and disperse light, and interact with moisture. Permaculture integrates practical considerations into organic principles and a natural aesthetic.

In general, permaculture design criteria for ecologically responsive structures require that building design and site layout are well suited to the landscape with minimum destruction of existing biosystems on the property. Natural, non-toxic building materials are emphasized.

Examples of innovation in building materials are strawbale construction or use of sandbags to create domed and vaulted structures which are earthquake resistant. Energy efficiency techniques, including passive solar heating and cooling systems are favored. Water systems are integrated with edible landscapes. Organic forms and shapes promote health and a sense of well-being.

Water Management

In any permaculture design, water is a priority. Integrated water systems may be developed in a variety of ways. Rooftop rainwater catchment cisterns are placed in combination with overflow ponds to feed landscapes. Recirculation systems are used to create secondary and tertiary cycles of water use, such as greywater lines to reed beds or irrigated zones and handbasin drainage to toilets. Canopy around and between structures through trellis and arbor-covered pathways creates cooler microclimates and reduces evaporation. Wastewater is treated with natural aquatic purification systems, using plants, fish and microbial organisms to filter, purify, and recharge water supplies.

Earth Restoration Strategies

Broadscale land reclamation and watershed restoration are universal objectives of permaculture designers, who could also be considered "bio-engineers." Some of the strategies utilized are:
erosion control - using swales (trenches) on contour, gabions or check dams, water bars off roadways, specific kinds of plants, and reduced tillage;
soil rehabilitation - using sheet mulching, green manure cropping, and nitrogen fixing plantings;
reforestation - stabilizing soils and recharging aquifers through a diverse mix of tree species;
animal management systems - designing rotational grazing systems with living, edible fence rows;
succession strategy - phasing plantings from hardy "pioneer" species to climax crops; and
shelter belts - creating protective micro-climates and wildlife corridors.

Perennial Agriculture

The word "permaculture" was originally conceived as a contraction of permanent and agriculture. Permaculture design for food production places emphasis on perennial agriculture, primarily through the design of forest gardens. Root crops, edible ground covers, herbs, shrubs, and bushes are interplanted among economic tree species to create planned orchard ecosystems.

Some of the design features typical of permaculture forest gardens are briefly described:
pattern and edge - using horizontal and vertical space to achieve the most efficient patterns for access, solar exposure, shade, condensation, water flow, wind, and microclimates;
soil building - mulching to build layers of top soil, with emphasis on leguminous (nitrogen fixing) species and green manure cropping;
perennial and native plantings - emphasizing local native species and perennial cropping;
polyculture - using a beneficial mix of species to generate system dynamics and strengthen immunity;
water harvesting - optimizing water use through drylands strategies; and
nutrition-based planning - incorporating local nutritional and health considerations into garden design.

Environmentally Benign Technologies

Technology selection is an important component of whole systems design for sustainable development.
Some useful guidelines are that the technology: 1) creates no pollution or toxic costs in its production; 2) is generally small scale with lower capital inputs; 3) applies to a broad spectrum of global demographics; 4) is bioregionally and culturally adapted; 5) has a long life cycle; 6) is based on renewable or solar energy; 7) tends to be humanizing and empowering; 8) helps build capacity for self-reliance; and 9) often converts waste into resources.

Permaculture has attracted a culturally and professionally diverse body of practitioners, including architects, gardeners, builders, d[illegible]ers, teachers, city planners, government officials and homeowners.
In South America, permaculturists provide an alternative to rainforest destruction by developing regenerative industries such as botanical pharmaceuticals; in Africa, desert lands are being converted into forest gardens; in Australia, dozens of "eco-villages" have been created based on permaculture design. "Village Homes" in Davis, California, designed by Mike Corbitt, is a good example of permaculture design applied to planned subdivisions.

For more information on permaculture design consulting, contact:
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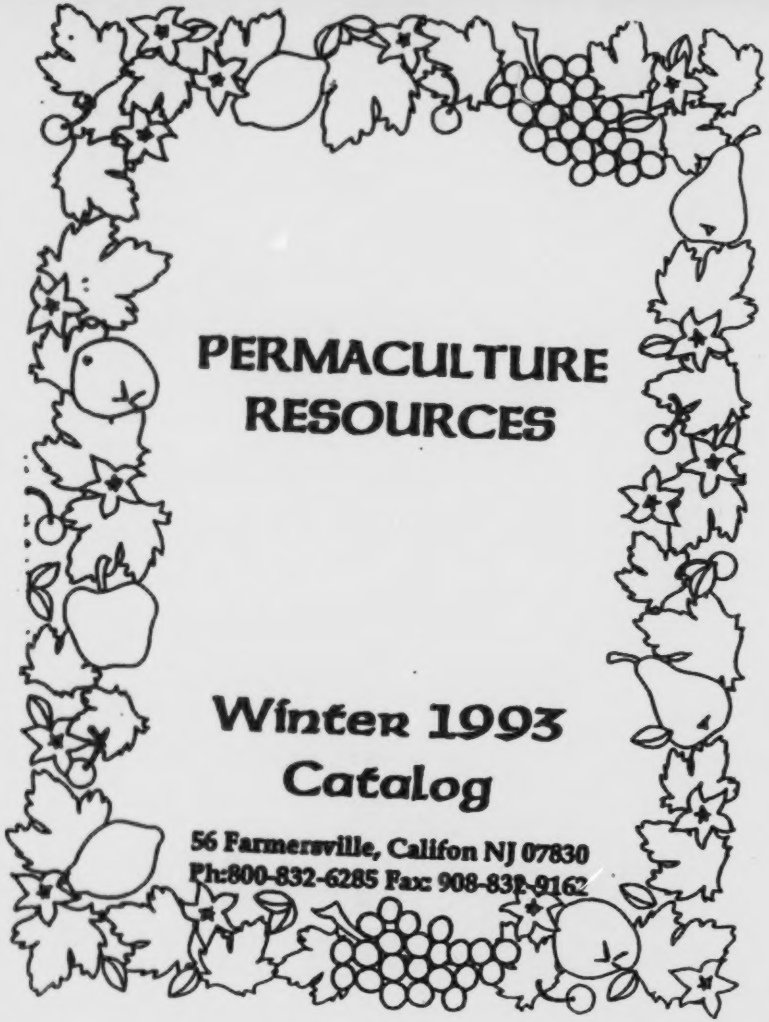
Director of Research and Permaculture Program Development,
Sol y Sombra Foundation,
4018 Old Santa Fe Trail,
Santa Fe, NM 87505
(505) 982-2752



PERMACULTURE RESOURCES

Winter 1993 Catalog

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SUSTAINABLE COMMUNITY AND VILLAGE DESIGN

Living Communities by Ben Haggard. ISBN 0-9639546-0-1. $12.95
The story behind the design and evolution of Sol Y Sombra, a private learning center on the former Georgia O'Keefe estate in Santa Fe, New Mexico. Into a meticulous account of the project, Ben artistically weaves his philosophical observations of the challenges involved and the human impact of implementation.

Conceptual Permaculture Report - Crystal Waters Permaculture Village by Max O. Lindegger and Robert Tap. 80 pages; Illustrations. $16.99
Crystal Waters is the world's first community designed from inception according to the principles and concepts of Permaculture. This is the detailed conceptual report for residents that presents the philosophy and land design of this ecologically-designed development. The 260-hectare Crystal Waters property was designed to accommodate 83 residential lots, a village commercial center and visitors' lodging.

Crystal Waters Permaculture Village Owners Manual by Nascimanere Pty. Ltd.
54 pages; Illustrations. $10.99
A companion to the conceptual report, the Owner's Manual reviews the human habitat "rules and regulations". It also offers house site location and construction design guides.

MAGAZINES – Permaculture Resources is pleased to offer current issues of the following permaculture magazines (prices and contents vary by issue):

The Permaculture Activist Edited by Peter Bane, Tennessee.
"A Quarterly Voice for Permanent Culture in North America", the Activist publishes articles ranging from designs to recent topics at local convergences.

The Permaculture Edge Edited by Max Lindegger et al, Maleny, Queensland, Australia.
"The Permaculture Edge" refers to the "edge effect" that can be used to increase yields in designed systems, and points to permaculture ideas as being "at the edge" of change in the push toward a sustainable future.

Permaculture: Solutions for Sustainable Living Permanent Publications, Hampshire, England.
This quarterly publication has articles geared for those interested in practicing permaculture--from beginner to designer. Its clear, easy to read format gives practical and enjoyable tips for integrating permaculture into your lifestyle. Although it is published in the UK, its articles are somewhat general and geared more for temperate style living.

Permaculture International Journal - Permaculture International Ltd., Lismore, Australia:
The PIJ has been keeping people informed on the permaculture movement since 1978. Focusing on solutions rather than problems, the Journal provides practical information, reports on projects around the world and serves as an international directory for permaculture services and events.

PERMACULTURE AND SUSTAINABLE DEVELOPMENT

Permaculture: A Designers Manual by Bill Mollison. ISBN 0 908228 01 5.
579 Pages; 400 Illustrations; Forty 4-color plates; Hardbound. $39.95
This text outlines a method for designing environmentally sensitive and ecologically stable systems - from rural homesteads to urban neighborhoods. Written for designers, students, farmers, gardeners, small and large property owners, agroforesters, ranchers, landscape designers, architects, engineers and planners, it presents concepts, strategies and methods of designing and constructing sustainable systems. Based upon the ethical use of our natural resources, Permaculture (permanent agriculture) is the conscious design and maintenance of agriculturally productive integration of landscape and people, providing food, shelter and other material and non-material needs in a sustainable way. Permaculture is a philosophy and an approach to land use which weaves together microclimate, annual and perennial plants, animals, soils, water management, and human needs into intricately connected and productive communities.

* Introduction to Permaculture by Bill Mollison and Reny Mia Slay. ISBN 0 908228 05 8.
200 Pages; 140 Illustrations; Paperback. $22.95
This updates and revises the first two Permaculture books, Permaculture One (Mollison & Holmgren, 1978) and Permaculture Two (Mollison, 1979). It is a concise and straightforward presentation of Permaculture design principals. Topics in this book include: energy-efficient site analysis, planning and design methods; house placement and design for temperate, dry land and tropical regions; urban permaculture - garden layouts, land access and community funding systems; using fences, trellis, greenhouse and shade house to best effect; chicken and pig forage systems; tree crops and pasture integration for stock; orchards and house woodlots for temperate, arid and tropical climates; permaculture gardens - energy saving designs and techniques; how to influence microclimate around the house and garden; large section on selected plant species lists with climatic tolerances, heights and uses.

The Best of Permaculture: A Collection by Max O.Lindegger and Robert Tap.
ISBN 0 9589585 1 3. 136 Pages; Illustrations; Paperback. $12.99
A collection of works that have appeared in Newsletters published by various Permaculture Groups and the International Permaculture Journal. Topics include articles on values, people, design and practice by selected authors such as Bill Mollison, David Holgrem, Max Lindegger, Stuart Hill, Terry White, David Wallingford, Kim Christie and lots of others.

Permaculture in a Nutshell by Patrick Whitefield. ISBN 1 85623 003 1.
85 Pages; Illustrations; Paperback. $7.99
A concise and accessible guide to the principles and practice of permaculture in temperate climates. Nutshell explains how permaculture works in the city, in the country, and on the farm. It also explores ways in which people can work in co-operation to recreate real communities. "Essential reading for everyone wishing to find creative solutions for reducing their environmental impact."

URBAN Permaculture: A Practical Handbook for Sustainable Living by David Watkins.
ISBN 1 85623 002 3. 162 Pages; Illustrations; Paperback. $12.99
A do-it-yourself handbook for those living in more intensive temperate suburban or urban settings. Urban Permaculture offers many clear and simple ways to apply a sustainable living approach to any homestead, with or without access to open land.

In Grave Danger of Falling Food. Video; 52 minutes. $29.95
Part of a series of four documentary films, this video focuses on Bill Mollison, author of the "Permaculture" concept and recipient of the "Alternative Nobel Prize". Mollison believes that the single most destructive force on the planet is modern agriculture. He has proposed a designed system of agriculture which uses the engineering principles of nature itself. This has taken hold in many developing countries. He combines hundreds of species - plant and animal - into a fertile self-regulating eco-system. His designs apply to the city as well as to the country, they can work in any sort of climate and once matured, have the potential to provide most of the food for any household.

The Global Gardener. Video; Approximately 2 hours. $49.95
Subdivided into four half hour parts describing and illustrating examples of Permaculture projects in four climates, this dramatic story proves the incredible results of sustainable development. The film features Bill Mollison and numerous teachers and practitioners of Permaculture throughout the world.

The Song of the Earth by Jamie Hamilton. 65 pages; Illustrations; Spiral bound. $10.00
A Masters Thesis, submitted for the Degree of Master of Arts in Sustainable Agricultural Permaculture, The Song of the Earth is an investigation into the use of the permaculture design method in approaching our current social, environmental and economic problems. It seeks to design a sustainable global human economy -- one that meets our needs without compromising the ability of future generations to meet theirs. Through a process of observation, analysis and synthesis it re-discovers the vital role of the individual in creating a sustainable world system. Includes great bibliography on the subject!

Third World Resource Guide by Michael G. Smith and Michael Pilarski. 40 pages; Spiral bound. $5.00
Compiled by Friends of the Trees, a non-profit organization dedicated to world reforestation, this is an extensive source book of names, addresses and brief description of grass roots groups working in sustainable agriculture, forest management and community development in developing countries. Includes selected reviews of journals, newsletters, books, directories, bibliographies, films and articles.

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NUTRITION, FOOD PRODUCTION, AND NATURAL FARMING PRACTICES

Ferment and Human Nutrition by Bill Mollison. ISBN 0-908228-06-6. 288 pages; Illustrations; Paperback. $29.95
An exciting journey towards understanding the basis of human nutrition presented with science, humor, and common sense. This is not a recipe book in any ordinary sense; its intention is to teach people to store and process their own food and to make their own ingredients. It is a basic survival handbook which is of great use to gardeners and farmers to vary their resource base by adding value to their crops. It is the book we all wish we had when we started gardening - it takes the mystery out of complex ferment processes and offers guidelines for the rich and varied diet we all need in this age of fast-food malnutrition. Good eating!

Designing and Maintaining Your Edible Landscape Naturally by Robert Kourik. ISBN 0-9615848-0-7. 370 pages; Illustrations; Paperback. $20.00
Kourik's knowledge of landscape techniques and data is encyclopedic. In this comprehensive guide he presents this knowledge in a well-organized and interesting fashion. His holistic approach to gardening gives one a simple understanding of soil conditions, gardening methods, and edible plant design ideas that will revolutionize your way of thinking about the beauty and practicality of edible plant design. Afraid the neighbors will think you a bit different for using edibles? This book will show you how to get them salivating over your aesthetically pleasing design and watching with wonder the insect and bird interaction.

Backyard Market Gardening by Andy Lee. ISBN 0 96246448 0 5. 351 pages; Illustrations; Paperback. $24.95
Discover how easy and profitable it is to grow and sell vegetables, fruits, flowers, herbs and small livestock from your own backyard. This book covers the scope of both gardening and marketing aspects to starting your own market garden -- from improving your soil to earning top dollar for your products; from buying necessary tools to organizing a community farmers' market. This is a resource for learning about sites, climate, compost, irrigation, greenhouses, pest and weed control, organic fertilizer, and maximum use of space; but it's also about marketing strategies, community gardens/farms, profitability, efficient selling, business plans, credit and capital. Small scale agriculture as described by Andy Lee can be very rewarding to the soul, the environment and the household salary. This book shows you how to do what you can, with what you have, where you are.

Drip Irrigation for Every Landscape and All Climates by Robert Kourik. ISBN 0961584823. 128 pages; 76 drawings; Detailed index. $12.00
The only book on the topic of drip irrigation for the home gardener. Drip irrigation stimulates higher yields that any other type of irrigation, in virtually every climate. Detailed how-to drawings and step-by step advice.

Sub-Tropical Fruit Poster by Nascimanere Pty, Ltd. $10.00
Beautiful presentation of sub-tropical fruiting plants and trees and their uses.

NATURAL AND SUSTAINABLE BUILDING TECHNOLOGIES

A Straw Bale Primer by S.O. MacDonald and Orien MacDonald. 25 pages; Illustrations. $10.00
Short and precise, this booklet explains through excellent illustrations how to build a straw bale structure. Besides specifications for the straw bale portion, the authors describe specs for the footings, windows and photovoltaics. One of a kind information.

Straw Bale Construction, the Elegant Solution - Video; Approximately 30 minutes. $29.95
Understand first-hand the benefits of straw bale construction by watching this personal testimony from a group in Arizona. Their personal experiences will inspire you to plan your own structure.

A Straw Bale Video Workshop - Approximately 30 minutes. $39.95
A practical how-to tape that presents a detailed demonstration of constructing a straw bale structure. Complete with some simple and clear plan diagrams, it takes one through all steps of straw bale construction.

Gap Mountain Composting Toilet by Doug Clayton and Dave Jacke. 32 pages; Illustrations. $12.00
Here's a new way to treat and re-use human wastes- the Mouldering Toilet! In a process patterned after the slow, cool decomposition of the forest floor, this system turns human waste into a "duff" which can be used to fertilise trees and shrubs in the home landscape. This Technical Bulletin explains how the system works and tells you how to design, build and use your Mouldering Toilet in a safe, effective and ecologically sound manner.

Gray Water Use in the Landscape: How to help your landscape prosper with recycled water by Robert Kourik. ISBN 0-9615848-1-5. 25 pages; 11 Illustrations; $6.00
Plants grow better with gray water because it comes with fertiliser already added! Plumbing opticins and parts are fully described. Appendix of safe soaps and detergents.

Permaculture in the Bush by David Holmgren. 29 pages; Illustrations. $9.99
Translated into "American", this is a detailed homesteader's dream--full of designs and illustrations. This case study design shows permaculture principles applied to the unique conditions of a particular site and locality by one of permaculture's foremost practitioners.

The Flywire House: A Case Study in Design Against Bushfire by David Holmgren. 15 pages; Illustrations. $9.99
Another classic Holmgren design, this booklet was first produced as an example of integrated design in the aftermath of the catastrophic Ash Wednesday fires of 1983. It uses a property in the Dandenong Ranges in Victoria as a case study and provides a wealth of information about the principles and practice of fire resistant design, construction and management in ways which are energy efficient, sustainable and productive - the essence of permaculture.

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5: Developing School-yard Habitats Prog.

WILD Coordinators Survey on Schoolyard Habitat Programs *

A	B	C1	C2	C3	C4	D1	D2	D3	D4	D5	E	F1	F2	F3	F4	F5	F6
Alabama	✓					✓	✓		✓								
Alaska			✓														
Arizona	✓	✓	✓					✓			✓		✓				
California											✓						
Colorado	✓	✓	✓	✓			✓	✓	✓								
Delaware	✓	✓	✓			✓	✓					✓	✓	✓	✓	✓	
District of Columbia	✓		✓				✓				✓						
Florida	✓	✓	✓			✓		✓				✓	✓	✓		✓	
Georgia		✓	✓			✓	✓	✓	✓					✓	✓	✓	
Illinois	✓	✓	✓	✓		✓		✓	✓			✓		✓		✓	
Indiana	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	maintenance
Iowa											✓						
Kansas	✓	✓	✓	✓		✓	✓	✓	✓			✓		✓	✓	✓	grantwriting
Kentucky	✓	✓					✓	✓	✓					✓	✓		
Maine	✓	✓	✓			✓			✓				✓	✓	✓	✓	
Maryland	✓	✓	✓	✓		✓	✓		✓				✓	✓		✓	
Massachusetts											✓						
Minnesota **																	
Mississippi		✓	✓	✓			✓		✓						✓	✓	
Nebraska	✓	✓	✓					✓	✓			✓		✓		✓	plants, grants
New Hampshire	✓	✓					✓	✓	✓			✓	✓		✓	✓	
New Jersey	✓	✓					✓	✓	✓	contest / recognition		✓	✓	✓			curr. int., grants
New Mexico	✓	✓	✓				✓	✓	✓		✓						
North Carolina	✓	✓	✓	✓								✓	✓	✓	✓	✓	
North Dakota	✓	✓	✓					✓						✓	✓	✓	
Oklahoma	✓						✓	✓	✓		✓			✓	✓		
Oregon		✓					✓	✓	✓		✓	✓					
Pennsylvania	✓	✓	✓	✓			✓		✓				✓				biodiversity, i.d.
South Carolina	✓	✓	✓				✓	✓						✓	✓	✓	
South Dakota									✓		✓						
Tennessee WILD	✓		✓				✓	✓	✓	award / certification		✓	✓		✓	✓	
Texas	✓	✓															
Utah	✓	✓					✓	✓	✓								
Vermont	✓						✓		✓								
West Virginia	✓	✓	✓				✓	✓	✓		✓		✓	✓	✓	✓	project benefits
Wyoming	✓	✓	✓			✓	✓	✓	✓						✓	✓	classrm present
Tennessee TWRA	✓	✓	✓				✓	✓		refer to TN WILD				✓			

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* *results compiled March 30, 1996 by Marilyn Wyzga, Project HOME, NH Fish & Game Department*

** *SNAP (School Nature Area Project) coordinates this program in Minnesota*

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WILD Coordinators Survey on Schoolyard Habitat Programs *

G	H	I	J	K	L	M	N	O
					yes		✓	✓
						✓	✓	
				✓			✓	✓
								✓
						✓	✓	✓
6		Master Gardeners				✓	✓	✓
				✓	directory		✓	
6		Coop.Ext.	✓				✓	✓
6	375 indivs.	GA Wildlife Fed.		✓	yes			✓
3						✓	✓	✓
2-8	400 in directory	SCS, USFWS, NWF, etc.		✓	directory, electronic b.board	✓	✓	✓
							✓	
6 or 12 hrs.	16+	SCS, local sponsors		✓	newsletter, reg. directory	✓	✓	✓
not standard	100?	KYEE Council, Nat.Res.Con.Serv.		✓			✓	✓
6-7 hours	10		✓	✓	newsletter	✓	✓	✓
6 hours	5	USFWS		✓	yes	✓	✓	✓
						✓	✓	
						✓	✓	✓
							✓	
2-3 hours	6	Nat. Res. Districts		✓				
6 hours	30+		✓		mailing list	✓	✓	✓
4-6 hours	15+	DEP. SCD. Cty Parks. Coop Ext. etc.	✓	✓	not yet	✓	✓	✓
			✓	✓		✓	✓	✓
30+	4			✓	not yet	✓	✓	✓
4 hours	1		✓	✓			✓	
not standard	?						✓	✓
not standard	10+	Wild.Fed., Coop Ext	✓	✓	email	✓	✓	✓
6-8 hours	40+	State Parks. Con. Dis., Audubon		✓	newsletter		✓	✓
4 hours	35	yes				✓	✓	
						✓	✓	
1 wk acadmy		TN Con. League. TN Forestry Asso	✓	✓	newsletter, directory			✓
					WILD newsletter		✓	
						✓	✓	
				✓	newsletter	✓	✓	
3	4				newsletter	✓	✓	✓
2-4 hours	25-50	USFS, BLM, UW		✓			✓	✓
not wkshp	4	DOE, NRCS		✓	newsletter			

results compiled March 30, 1996 by Marilyn Wyzga, Project HOME, NH Fish & Game Department

*** SNAP (School Nature Area Project) coordinates this program in Minnesota*

KEY TO Coordinators Survey on Schoolyard Habitat Programs

A	State responding to survey
B	Have some kind of schoolyard habitat program in place
Focus of habitat program is:	
C1	wildlife habitat enhancement
C2	curriculum/outdoor classroom
C3	action
C4	other
Habitat program currently serves schools with:	
D1	workshops/teacher training
D2	consultations/site visits
D3	grants and other funding
D4	recommended resources
D5	other
E	Plan to establish a schoolyard habitat teacher training program
Current schoolyard teacher training program includes:	
F1	team building
F2	map making
F3	instruction on specific habitat enhancement projects
F4	curriculum development
F5	site inventory process
F6	other
G	Length of teacher training workshop
H	# schools trained to date (March 15, 1996)
I	Partner agencies in training program
J	Train facilitators to conduct schoolyard workshops
K	Utilize habitat demonstration sites
L	Have means to link schools in a network
M	Distribute or recommend Homes for Wildlife (NH Fish & Game publication)
N	Distribute or recommend WILD School Sites (Project WILD publication)
O	Interested in a national conference or meeting on schoolyards

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An excerpt from Project WILD's *TAKING ACTION: An Educator's Guide To Involving Students In Environmental Action Projects.*

DEVELOPING OUTDOOR STUDY HABITATS

An outstanding environmental study area may be just outside the door. Some schools have wooded acreage or a stream nearby. Other schools, especially in the inner city, must work creatively with their physical site. Many zoos, nature centers, museums, and other facilities have property that can be improved or transformed into study sites with tremendous potential for visitor education. The scope of potential projects and site development work varies greatly. In some cases, a few simple enhancement steps will be all an area requires. In others, a major investment of time and energy is needed before a site can really be used for environmental study. That restoration work, however, can provide important lessons in itself.

> When we see land as a community to which we belong, we may begin to use it with love and respect.
>
> *Aldo Leopold, American writer and conservationist*

STUDENTS IN ACTION

Going Wild About Birds

After participating in activities from Project WILD, an environmental education program, students at Mountain View Elementary School in Lacey, Washington, decided to make their school more attractive to wildlife, especially birds. Working in groups, the sixth graders researched birds, birds' habitat needs, and native plants. Each group then designed a garden and made a presentation to the class. After the presentations, students voted on the design they liked best; then they set about making it a reality!

Local nurseries, students' parents, and friends donated plants. The school district provided organic amendments for the rocky soil. Students solicited donations and loans of shovels and rakes. Interns from nearby Evergreen State College provided advice on where to obtain resources and how to plant.

The garden was filled with beautiful native plants, and it succeeded in attracting many birds (and observant students!). The students' written observations about their gardening experiences are revealing. They learned "how to work with a lot of people," "how to understand other people's ideas," and "how to look up needed information."

"It's given me a better chance to work with my friends," said one student. "I like to dig and plant."

"I learned about birds and their habitats," reported two others.

Cathy Tarabulski and Nova Burke, Mountain View Elementary School, 1900 College St., Lacey, WA 98503; (206) 493-2811.

STUDENTS IN ACTION

Oh, Give Me a Prairie Where the Butterflies Roam!

For students at Fredstrom Elementary School in Lincoln, the prairie that once covered Nebraska is no longer just something to read about in history books. In 1990, the students, their teachers, and parents decided to recreate a native prairie and butterfly garden on a 60-by-130-foot (18-by-40-meter) plot on the school grounds. With the help of a small grant, the group obtained necessary materials and tools, as well as the services of a prairie restoration expert, to further their project. A steering committee of teachers from several grades coordinated student learning and day-to-day involvement.

The students planted seeds indoors in peat pots during the winter, then transplanted the seedlings to the garden area in May. They built bark paths through the garden and prairie. Both wild and domestic plants were used to attract butterflies. The students also started a compost pile for disposal of garden waste, and they used the mulch to enrich the garden soil. Every second year, a rangeland expert from a local university burns the prairie to maintain its viability.

Teacher Rosemary Thornton says, "An important concept that I stress is that the garden and prairie are refuges for creatures, and that humans may be observers if they don't intrude. Children have learned respect for all creatures, including spiders and bees, as well as butterflies. They realize that plants, such as stinging nettle and milkweed, belong in our garden, and that if all so-called 'weeds' are eradicated, the result will be loss of habitat for many species of butterflies."

Rosemary Thornton, Fredstrom Elementary School, 5700 NW 10th, Lincoln, NE 68521; (402) 436-1140.

STUDENTS IN ACTION
No Garden of Roses!

"Just because you live in a desert area doesn't mean that you automatically appreciate it," according to Arlaine Tyler, teacher at Lenwood School in Barstow, California. After stimulating students' interest in the local environment through lessons from Project Learning Tree and Project WILD, she took her class on field trips to study nearby natural desert areas. The result? Enthusiastic students wanted to plan an outdoor area for viewing local desert plants and wildlife right on their school site.

Thanks to a $200 "seed" grant from the local Rotary Club, the fifth graders planted in their schoolyard 14 different plants indigenous to the desert. Over the next two years, they solicited other grants and donations so they could add plant name signs, library books, and more desert plants, including some endangered species.

The young people are so proud of their garden that they often choose to work in it during recess! They invite other students to visit the garden and educate those students about desert plants. Several young people have pursued desert research projects, and, for a service project, the fifth graders decided to clean up a desert area that had long been a site of unlawful dumping behind the school.

TEACHER'S HINT: "If I did this again, I would try to get more funding to begin the garden, so that students could see a change in the outdoor site sooner."

Arlaine Tyler, Lenwood Elementary School, 34374 Ash Rd., Barstow, CA 92311; (619) 252-7713.

STUDENTS IN ACTION
Happy Trails

Students in George B. Henry's seventh- and eighth-grade classes were concerned about construction projects encroaching on a nearby lake and the foothills of the Great Smoky Mountains. They wondered what they could do to educate children and adults about the beauty and uniqueness of this natural area. The answer they found was right in their own backyard.

Students decided to build a nature trail on the 12 wooded acres (4.9 hectares) that make up the campus of Friendsville Elementary School.

The Tennessee Department of Agriculture helped the classes to identify the different trees and map a potential trail. Next, students canvassed the community for volunteers to provide labor and materials, such as a local company that provided lumber, nails, and wood chips. While students did much of the labor, the Tennessee Air National Guard Civil Engineers took responsibility for the more difficult and dangerous jobs, such as cutting lumber, carrying heavy materials, and digging holes. Each class at the school was responsible for planting native trees and flowering plants and for maintaining a certain area on the trail.

The finished trail is three-fourths of a mile long (a little more than one kilometer), with bird, bat, and owl houses strategically placed along it. There are benches at various places to encourage brief rests or quiet contemplation. A 35-seat amphitheater, located on a steep grade, serves as an outdoor classroom.

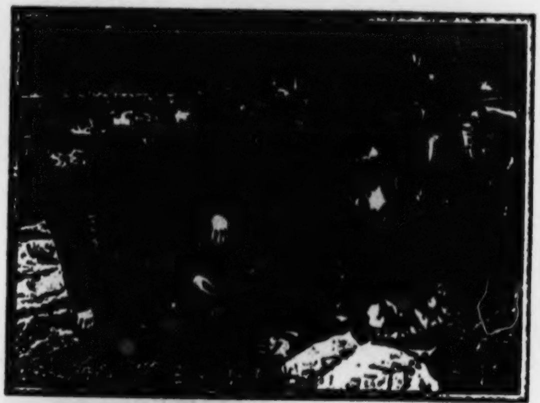
The trail and enhanced habitat offer the school and community a lovely woodland in which to appreciate and learn about their local area.

George B. Henry, Friendsville Elementary School, P.O. Box 119, Friendsville, TN 37737; (615) 995-2151.

STUDENTS IN ACTION

Students' Accolades for Prairie Project

Laurie Thompson, a teacher in Nerstrand, Minnesota, was responsible for getting students at her elementary school to undertake a cooperative project in prairie restoration. Thanks to her vision, every class in the school, from kindergarten through sixth grade, began to focus on a different aspect of the prairie. Some raised seedlings in the classroom, for example, while others traveled to Nerstrand Big Woods State Park to plant seedlings in the spring.



Students' reactions were enthusiastic. All of the speakers at Nerstrand's sixth-grade graduation mentioned the value of the prairie project, both in helping the environment and in creating personal and school pride.

Because of the students' response, prairie restoration has been integrated into the school curriculum. What's more, the project has forged a valuable partnership among students, teachers, community members, and the local Department of

Natural Resources. The state park has received valuable labor for its prairie restoration activities, and the students have gained a connection with the community and natural environment.

This program is one of many in the School Nature Area Project (SNAP), which is co-sponsored by Saint Olaf College and the Blandin Foundation.

Nalani McCutcheon, School Nature Area Project, Saint Olaf College, 1520 Saint Olaf Ave., Northfield, MN 55057-1098; (507) 646-3906.

STUDENTS IN ACTION
The Garden of Dreams

At first the students joked that butterflies would never come to their garden. But the butterflies did come. And the students' "Garden of Dreams" lived up to its name. It is one of many beautification and outdoor study areas that are part of the campus of Miami Sunset Senior High School in Miami, Florida.

"Garden of Dreams" began in 1987 and starred students who were all enrolled in exceptional education classes for children with mental and emotional problems or with learning disabilities. Using money from the Ecology Club's recycling program, these students developed a landscaping plan for the campus and did the first round of planting.

Since then, student and teacher involvement has grown each year. The school now has not only a butterfly garden but also a pond, an organic vegetable garden, birdbaths and bird feeders, and over 1,000 trees and shrubs. The students compost plant debris and use the mulch for their plantings. They have painted environmental murals on many outside walls. The school grounds have been registered as a certified Backyard Wildlife Habitat by the National Wildlife Federation.

BACKYARD WILDLIFE HABITAT PROGRAM

Certificate of Achievement

Miami Sunset Senior High School

The exceptional education students' interest in the work continues to be strong, and in 1993 they began another garden. This one is located in the Miami MetroZoo, parts of which had been devastated in 1992 by Hurricane Andrew. Students planted a 10-by-15-foot (3-by-4.6-meter) garden featuring butterfly-attracting plants. Teacher Linda Speedy notes that her students "...love to watch things grow. Whenever they plant, it's a sense of accomplishment. They say to themselves, 'I can do, create, and make a difference.'"

Lee Jacobs, Pam Schockey, and Linda Speedy, Miami Sunset Senior High School, 13125 SW 72nd St., Miami, FL 33183-0299; (305) 385-4255, ext. 205.

STUDENTS IN ACTION
Calling All Wildlife!

How does an overgrown field that is frequently used for dumping become a beautiful historical park? Just ask the biology students at Rogers High School in Spokane, Washington. After using the undeveloped Drumheller Springs Park for wildlife field studies, students decided to mount a landscaping effort in this historically significant area.

Students began planning in 1991. They sent surveys on park restoration to 40 homeowners living near the park and received supportive responses. In fact, several residents volunteered to water new plants during the summer. Students also inventoried plants and animals, mapped the area, identified soil types, pulled noxious weeds, posted "No Dumping" signs, and cleaned up trash.

The second step was to increase the variety and numbers of wildlife in the park. Each of the school's eight biology classes was responsible for one section of the 13-acre (5.3-hectare) park. To map each section, students used a computer landscape program to draw existing vegetation and create a landscape plan. After researching the characteristics, requirements, and wildlife value of potential shrubs, the students selected 14 native species.

In May 1993, the students planted more than 300 shrubs. Third-grade students from four nearby grade schools teamed with high school students to help out. The high school students prepared booklets about wildlife enhancement for the third graders before they met to plant the shrubs together.

Students from the REAL School, an alternative high school in the area, are videotaping the history of Drumheller Springs Park. Among the facts they have uncovered is that the park has a spring that provided the only nearby source of water many years ago. The park was also the site of the community's first school.

Cash and in-kind assistance have come from the Spokane County Conservation District, the Girl and Boy Scouts, Gonzaga University Ecology Club, and local historical groups. Funding has also come from the Washington State Department of Wildlife and a Phillips Petroleum Partnership Grant.

The students plan to plant more shrubs each year, and they are constructing homes for birds and bats and are building shrub piles to encourage wildlife. The most gratifying evidence of success is that Drumheller Springs Park has blossomed!

Mary Jean Porter, John R. Rogers High School, 1622 E. Wellesley, Spokane, WA 99207; (509) 353-4540.

Inspiration for Other Actions

- Have an essay contest in which students are asked to describe the value of their outdoor study area on their learning. Submit the best stories to local media—a great way to gain continued support for your project. Ask students to write letters to local businesses and organizations to determine their interest in supporting a schoolyard habitat project.
- Take your students to local interpretive trails. This trip will prepare and inspire them in the development of their own outdoor study site.
- Encourage students to adopt an area of the playground, then to formulate plans for its improvement, secure needed resources, and carry out their strategy.
- Create a school beautification plan in which students from all grades can participate. Videotape the project from planning through completion. Share the video with other schools, parents, and community members.

To Find Out More

PUBLICATIONS

Cronin-Jones, Linda. *The Schoolyard Wildlife Activity Guide*. 1992. Florida

Game and Fresh Water Fish Commission, 620 S. Meridan St., Tallahassee, FL 32399-1600.

Design Your Own Home Landscape: A Computer Program. MAC Warehouse, 1720 Oak St., Lakewood, NJ 08701-3013; (800) 255-6227.

Guidelines and Features for Outdoor Classrooms. Indiana Department of Natural Resources, Division of Forestry, 402 W. Washington, Room 296, Indianapolis, IN 46204; (317) 232-4105. Free.

Henderson, C.L. *Landscaping for Wildlife.* 1987. Minnesota Department of Natural Resources, 500 Lafayette Rd., Box 7, St. Paul, MN 55155-4007.

Homes for Wildlife: A Planning Guide for Habitat Enhancement on School Grounds. 1993. New Hampshire Fish and Game Department, 2 Hazen Dr., Concord, NH 03301.

Lipkis, A., and K. Lipkis. *The Simple Act of Planting a Tree: A Citizen Forester's Guide to Healing Your Neighborhood, Your City, and Your World.* 1990. Jeremy P. Tarcher, Los Angeles, CA.

Murray, M.F. *Prairie Restoration for Wisconsin Schools.* University of Wisconsin Arboretum, Madison, WI 53705; (608) 263-7888.

Tufts, Craig. *The Backyard Naturalist.* 1987. National Wildlife Federation, 1400 16th St. NW, Washington DC 20036-2266.

Weston, Shann. *Naturescaping—A Place for Wildlife.* 1992. Oregon Department of Fish and Wildlife, P.O. Box 59, Portland, OR 97207.

WILD School Sites: A Guide to Preparing for Habitat Improvement Projects on School Grounds. 1993. Project WILD, 5430 Grosvenor Lane, Bethesda, MD 20814; (301) 493-5447. $5.

ORGANIZATIONS

American Forestry Association, Global ReLeaf Program, P.O. Box 2000, 1516 P St. NW, Washington, DC 20013; (202) 667-3300. Promotes reforestation. Has a teacher's packet.

Bat Conservation International, P.O. Box 162603, Austin, TX 78716; (512) 327-9721. Promotes bat conservation projects.

National Association of Conservation Districts. Local chapters in many areas. For general information, write to 509 Capitol Ct. NE, Washington, DC 20002; (202) 547-6223. For publications, write to P.O. Box 855, League City, TX 77574; (800) 825-5547.

National Wildlife Federation, 8925 Leesburg Pike, Vienna, VA 22184-0001; (202) 797-6800. Through its Backyard Habitat Program, provides a certificate to recognize outdoor site development. Various publications, including *Gardening with Wildlife.*

The Xerces Society, 10 SW Ash St., Portland, OR 97204. Information about butterfly gardening.

Project WILD
Supplementary Materials

Taking ACTION–An Educator's Guide to Involving Students in Environmental Action Projects

The purpose of *Taking Action* is to inspire ideas and provide models for conducting effective environmental projects--projects that dynamically engage students from start to finish. From adopting species to protecting habitats to saving energy and creating publications, this guide will help educators plan, implement, and evaluate environmental action projects. It includes a rationale for action, a step-by-step planning process, educational tips, and a bibliography and a resource list for more information. Samples of more than 30 projects from around the country provide a glimpse of how groups of students have seen a need in their community and successfully worked together to implement change. This guide was developed in cooperation with the World Wildlife Fund.

WILD SCHOOL SITES–A Guide to Preparing for Habitat Improvement Projects on School Grounds

School grounds can be healthy habitats for people and wildlife. They can be places where students learn to make a difference and improve the quality of the environment in which they live. This guide helps students and teachers learn about the importance of biodiversity, understand the basic steps of creating a wildlife habitat, develop a plan for action, and gain community support. The goal of this guide is to assist educators and their students in taking responsible action to improve their communities for people and wildlife--beginning on their school grounds.

EXPLORING SCHOOL NATURE AREAS (Video–13 min.)

Outdoor classrooms provide opportunities for exciting hands-on learning activities with students. Being able to see and work in nature areas increases students' enthusiasm for learning and has a positive impact on their self-esteem. This video was produced in cooperation with St. Olaf College's "School Nature Area Project." It is designed to inspire students and educators to take positive action for the environment, and it provides examples of outdoor classrooms around the country. It also shows how science, social studies, math, art, and other subject areas are reinforced in school nature areas and how students can apply lessons learned inside to the world outside.

SEE ORDER FORM ON BACK

project WILD

5430 Grosvenor Lane • Suite 230 • Bethesda, MD 20814-2412
Tel (301) 493-5447 • Fax (301) 493-5627
Email natpwild@igc.apc.org • Web http://eelink.umich.edu/wild/

Council for Environmental Education (CEE)
F.E.I.N. 82-0377903

Supplementary Material Order Form

Contact Name ______________________________
Organization ______________________________
Mailing Address ______________________________
____
____
____
Phone ______________________ Fax ______________________

Quantity	Description	Price Each	Amou
	WILD School Sites: A Guide to Preparing for Habitat Improvement Projects on School Grounds (64 pages)	$ 5.00	
	TAKING ACTION: An Educator's Guide to Involving Students in Environmental Action Projects (80 pages)	$ 7.00	
	Exploring School Nature Areas Video (13 minutes)	$16.00	
	WILD About Elk: An Educator's Guide (80 pages)	$ 7.00	

Shipping & Handling

If your order subtotals:	*Add:*
$30.00 and under	$3.00
$30.01 to $60.00	$4.00
$60.01 to $100.00	$5.00
$100.01 to $150.00	$6.00
$150.01 and over	$9.00

SUBTOTAL	$
5% Sales Tax (MD Residents Only)	$
← **Shipping & Handling**	$
TOTAL	$

Please make checks payable to CEE. Mail order form and payment to:

Project WILD
5430 Grosvenor Lane, Suite 230
Bethesda, MD 20814-2142

Please allow 4-6 weeks for delivery. Questions? Please call the Project WILD office at (301) 493-5447.

Site Assistance

The site in context

- **Ecological context**
    - **Biotic communities of Minnesota, the U.S.**
    - **woodlands, wetlands, prairies**
- **Historical context**
    - **Regional history**
    - **Local history**
    - **Site history**
- **Community context**
    - **Student use**
    - **Community use**
    - **Wildlife use**

Involvement with site planning and improvement

- **Site Caretaking Committee**
    - **teachers, community members, students**
    - **Identify problem areas**
        - access
        - quality of biological community
        - erosion, pollution, etc.
    - **Identify goals**
        - educational goals
        - conservation goals

Teachers

- **Increase awareness and knowledge of site**
    - Field trips
    - Workshops
    - Resources
- **Complement curriculum development process**
- **Build support for future activities**

Students

- **Site exploration activities**
    - inform the planning process
    - involvement in site projects
        - *native planting*
        - *habitat restoration*
            - bird houses, brushpiles
        - *trail development*
        - *student-initiated projects*
    - inspire future study
        - *plant inventories*
        - *site journals*
        - *restoration research*

THE SCHOOL NATURE AREA PROJECT ENVIRONMENTAL ACTION GRANTS

1997-98

Project GRANTS

FOR MINNESOTA SCHOOLS

Who should apply:

Any K-12 public or private school may apply, including schools who have previously been awarded SNAP Project and Partnership grants.

SNAP Project Grant Objectives

SNAP Project Grants provide opportunities for students to benefit the environment by

- planting Minnesota native vegetation or
- improving wildlife habitat

in an area near their school building. Individual classrooms, a combination of classrooms, or an entire school may apply.

Some project examples include planting native Minnesota vegetation appropriate to the local area, building feeding and watering stations, and developing animal homes such as rock piles, hibernation boxes, nesting platforms or spawning grounds. (See the *Resources for Schools* insert for resources on native plants and wildlife habitat.) Projects such as numbered interpretive signs along a trail or seating for an outdoor classroom, although valuable educational tools, do not fit the requirements of this grant.

This packet contains:

- *Grant guidelines*
- *Application questions*
- *Application cover page (insert)*
- *Resources for schools (insert)*
- *Sample application (insert)*

SNAP Partnership Grants

SNAP offers another grant program called Partnership Grants that assist schools with developing a nature area and with ecology and environmental education curriculum development. Partnership grants are designed for the involvement of a school, not an individual classroom. Call SNAP at 507-646-3599 to request a Partnership grant application.

Application Deadline: Dec. 9, 1996

Project Grant Guidelines

Overview

- Grant recipients receive $500 to $1500 cash for project expenses.
- 75% of the grant award will be disbursed to the school upon receipt of an approved project plan. Remaining funds will be disbursed upon submission of a final report verifying completion of the project and providing an itemized list of expenditures.
- Funded applicants will have an opportunity to hire a consultant to assist with their project. An additional $300 will be available to schools for a consultant. Consultants may be chosen by the school, or the school may ask SNAP to assist in recommending a consultant. The Project Coordinator will be sent information regarding consultants.
- SNAP will fund the registration for two teachers from your school to attend the Wolf Ridge Environmental Education Institute (EEI) on July 7-11, 1997. Schools pay a $30 registration fee per person and SNAP covers the remaining $170 per person. SNAP Project schools may send additional teachers to EEI at $200 per person (a reduced fee from $250 for other participants). Grant recipients will receive information on the EEI.
- Schools may submit multiple project applications, but an individual cannot be identified as Project Coordinator on more than one application. Each application is judged individually based on meeting grant requirements and its feasibility as a successful project. The number of applications from a school does not influence how many applications are funded.
- Twenty to thirty Project grants will be awarded.

Applicant Requirements

- Any public or private Minnesota school with students in any grades K-12 may apply.
- Schools must have a project area within easy walking distance of the school building, or show that adequate transportation and class time is available for trips, on a regular basis, to a site.
- Students must be involved in design, decision-making and implementation of the project. Involvement in planning may include site assessments to determine project feasibility, learning about native vegetation best suited for the site, learning about the habitat needs of wildlife of the area, meeting with the school principal to gain approval for the project, and meeting with local resource people to discuss the project. See the *Resources for Schools* insert for information on planning and implementing a project.
- These grants provide funds to conduct a specific project. Applicants need to show how the project will be integrated into the curriculum beyond the initial development phase. The proposed project should lay a foundation for future efforts to enhance vegetation or wildlife habitat on the site and lead to future educational activities at the site.
- SNAP recognizes that site access, such as trails, a boardwalk, or dock construction, may be a necessity for student use of a site. Some grant funds may be used to address access, but at least 50% of funds must be used to enhance native vegetation or directly benefit wildlife.
- Community involvement of parents, local businesses and organizations is encouraged.
- Proposed projects shall:
  - be in compliance with all state regulations as well as applicable federal, state, and local laws or ordinances (such as laws requiring permits to collect seeds from the wild).
  - be undertaken if a proposal is approved and funds are awarded.
  - have the support of school district administration, specifically the school principal.
- An *Interim Report* and a *Final Report* are required to document the progress of the project and status of expenditures. Reporting guidelines will be distributed to grant recipients.
- Grant recipients must be willing to participate in evaluation of the program. An outside evaluator or a SNAP staff member may visit a Project School during or after the grant period to interview participants and evaluate the Environmental Action Grants program.

Project Grant Timeline

December 9, 1996	Applications must be postmarked to SNAP.
February, 1997	Schools notified of awards.
March, 1997	Consultants arranged and project plans revised as necessary.
April, 1997	First award payment disbursed upon receipt of approved project plan.
November 3, 1997	Interim report due.
June 1, 1998	Final report due. Remaining award funds disbursed upon receipt of approved report.

Project Grant Application Questions

Please answer the following questions on separate paper. Responses must be typed. Please number your responses to each of the following questions. Please limit your responses to a total of five pages.

Site Information and Project Description

1. a. To the best of your ability, describe the area that you will be enhancing including its size, vegetation types, landscape features and topography.
   b. How is this land currently being used?

2. a. Describe the specific project for which you are seeking funds and how it will enhance native vegetation and/or wildlife habitat.
   b. List the different stages of the project and the major participants involved in each stage, including approximate dates for starting and completing each stage.

If you have a nature area that you plan to do a series of projects on such as a prairie planting, trail construction, tree planting, etc., pick one or two of these specific projects to describe. The budget information that you provide in question 8 will tie directly to the specific project you are planning to do. For a prairie planting, different stages might include selecting plant species in stage one, soil preparation in stage two, stage three may be the planting itself, stage four may focus on initial maintenance, and stage five describes long-term maintenance.

3. a. If your project includes plantings, list the native plants appropriate to your locale that will be used.
   b. If the project benefits wildlife, indicate some of the species you expect to benefit. (Consult the *Resources for Schools* insert for information on native vegetation and wildlife.)

4. On 8-1/2 x 11 paper, provide a current map of the area. Identify the school building and existing significant landscape features such as vegetation types, ponds, trails, bridges, and docks. Include proposed changes and mark existing features as "existing" and proposed features as "proposed." Show site dimensions.

5. If the land for your project is not owned by the school, please provide a signed statement from the property owner granting permission for the project to be conducted and for students to enter the property to maintain the project after the initial work is complete. Please specify for how long this use is granted.

Questions continued on back.

Project grant application questions continued

6. If your project site is not within walking distance of the school, please answer the following questions:
   b. How many trips will a classroom take to a site during the school year?
   c. How will trips to the site fit into the school day?

Student Involvement and Curriculum Connections

7. a. How have students been involved in the project's planning and design?
   b. How will students be involved in project implementation?
   c. How will students be involved in project maintenance? Include plans for summer maintenance.
   d. Share curricular connections for the ongoing use of the project.

Budget

8. Please provide a budget detailing expenses for the project. It should state clearly the total dollar amount requested from SNAP and which specific items will be paid for with SNAP funds. Any items that may not be clear should be explained.

At least 50% of the budget must be used on native vegetation or wildlife habitat. Examples of budget items that will not be funded are non-native plants, signs along trails or brochures, buildings or seating areas. A general request for $1500 to do a prairie planting will not suffice. A budget for a prairie planting may include the cost of hiring someone to till the land for a specific number of times before planting, the cost of a specific amount of seed to cover a specific sized area, and the cost of a certain number of seedlings for a specific area. Your total budget to SNAP can not exceed $1500. If your project costs more than $1500, clearly state the source of additional funds to complete the project.

Include enough detail in your budget to let us know that you've done some research on sources of materials and approximate cost; if your grant is funded, we may ask for additional detail as your plans are finalized.

Application Checklist

☐ Application cover page completed with appropriate signatures
☐ Answers to application questions
☐ Permission letter from landowner (if applicable)
☐ Original and 4 copies of above items mailed to SNAP (Please make copies 2-sided, if possible.)

The School Nature Area Project (SNAP)
St. Olaf College
1520 St. Olaf Avenue
Northfield, Minnesota 55057
(507) 646-3599

THE SCHOOL NATURE AREA PROJECT ENVIRONMENTAL ACTION GRANTS

1997-98

Project GRANTS

FOR MINNESOTA SCHOOLS

Application Cover Page

SCHOOL NAME ____________________ DATE ____________________

SCHOOL ADDRESS ____________________

CITY __________ COUNTY __________ STATE __________ ZIP __________

PHONE __________ FAX __________ E-MAIL __________

PROJECT COORDINATOR ____________________ POSITION ____________________

I have described the project as accurately as possible, and I intend to implement it within the grant period. I agree to submit an Interim Report and a Final Report with an accounting of expenses. Any funds not expended will be returned to the School Nature Area Project. I understand that the School Nature Area Project and/or any of its agents, officials and employees will assume no responsibility or liability for claims of damage of any kind to property or for claims of injury to any person in connection with the grant.

SIGNATURE OF PROJECT COORDINATOR ____________________ DATE ____________________

I approve the submission of this proposal and the implementation of the project herein described.

SIGNATURE OF PRINCIPAL ____________________ DATE ____________________

TYPE OR PRINT PRINCIPAL'S NAME ____________________

Send the original and four copies of this cover page and question responses to:
SNAP, St. Olaf College, 1520 St. Olaf Avenue, Northfield, MN 55057. Please make copies 2-sided, if possible.

Applications must be postmarked by December 9, 1996.

For mailing list information only: ☐ Our school has applied previously for a Project Grant ☐ Our school has received a Project Grant previously

1997-98

Project GRANTS

Resources For Schools

Homes for Wildlife: A Planning Guide for Habitat Enhancement on School Grounds by Marilyn C. Wyzga and the New Hampshire Fish and Game Department. Includes projects to enhance wildlife habitat on school grounds and Minnesota resources. $10.00 from SNAP.

Minnesota School Nature Areas: Notes on Benefiting the Biomes provides information on Minnesota's three major biomes. Guidelines for planning and creating a nature area are included with numerous resource materials relevant to Minnesota highlighted. $5.00 from SNAP.

Landscaping for Wildlife, *Woodworking for Wildlife*, and *Wild About Birds* are all by Carrol Henderson of the DNR Nongame Wildlife Program. Books include information on enhancing wildlife habitat, constructing nest boxes and feeding stations, and attracting and watching birds. Available from Minnesota's Bookstore, 117 University Ave., St. Paul, MN 55155. Phone 612-297-3000 or 1-800-657-3757.

Prairie Restoration for Wisconsin Schools by the University of Wisconsin Arboretum includes information on prairie history, ecology, curriculum resources, and a bibliography. Send $20.00 plus $3.00 for postage to UW-Madison Arboretum, 1207 Seminole Hwy., Madison, WI 53711.

Learning Under the Sun: School Nature Areas is a thirty-minute video for teachers highlighting Minnesota resources for school nature areas and environmental education. Produced by SNAP. $8.50 from SNAP.

Exploring School Nature Areas is a thirteen-minute video suited for classroom use showing students and teachers developing and using nature areas. Produced by Project WILD and SNAP. $8.50 from SNAP.

Sources of Minnesota Native Plants

Native Plant Nurseries

Landscape Alternatives, Inc.
1705 St. Albans Street, Roseville, MN 55113
Tel. 612-488-3142; Fax 612-488-3860
Specializes in prairie, wetland, and woodland plants and seedlings.

Prairie Restorations
P.O. Box 327, Princeton, MN 55371
Tel. 612-389-4342
Prairie and woodland plants and seedlings; prairie seed

Prairie Moon Nursery
Rte. 3, Box 163, Winona, MN 55987
Tel. 507-452-1362; Fax 507-454-5238
Prairie, woodland and wetland plants and seed. Mail order, plants shipped bare-root in spring and fall

Hummingbird Habitat Nursery
P.O. Box 102, Dassel, MN 55325
Tel. 320-275-3208
Native (and non-native) hummingbird- and butterfly-attracting plants. Mail order; shipped bare-root in spring

Outback Nursery, Inc.
15280 110th Street South, Hastings, MN 55033
Tel. 612-438-2771; Fax 612-438-3816
Specializes in Minnesota native trees, shrubs, and vines; also some prairie and woodland ferns and forbs.

Schumacher's Berry Farm and Wholesale Nursery
Rte. 2, Box 10, Heron Lake, MN 56137
Tel. 507-793-2288; Fax 507-793-0025
Native and non-native trees and shrubs; bare-root seedlings. Minimum order $150. Schools and nurseries only

Your local Soil and Water Conservation District; check phone directory under County Offices.
Native and non-native trees and shrubs; bare-root seedlings.

Last compiled by Char Bezanson, School Nature Area Project Ecologist, 4/96.

If you know of other nurseries that propagate Minnesota native plants that are not on this list, please drop a note or a catalog to Char Bezanson, SNAP, St. Olaf College, 1520 St. Olaf Avenue, Northfield, MN 55057.

SAMPLE

Sunny Meadows School Planting Project

Sample SNAP Project Grant Application

This fictional grant application is meant to give you an idea of the scope and level of detail that would be appropriate for a SNAP Project Grant application. Projects vary greatly, and yours may be more or less far along, but we hope this case is useful as an example. (Does not include cover page)

1. To the best of your ability, describe the area that you will be enhancing, including its size, vegetation types, landscape features, and topography. How is this land currently being used?

We are interested in enhancing an area, currently planted in lawn, directly east of the 4th and 5th grade classrooms. Its size is about 16,000 square feet (about 100 ft. x 160 ft.), and it is bounded on the east by an old windbreak consisting of mature Norway Spruce trees with occasional clumps of Large-Leaf Aspen. The area is on the side of the school, is low-traffic due to its distance from the main playground area on the west side of the school, and has no vegetation (aside from lawn) except for three existing Green Ash trees which were planted when the school was built on a former cornfield about ten years ago. The topography is level, with no outstanding features.

2 a. Describe the specific project for which you are seeking funds and how it will enhance native vegetation and/or wildlife habitat.

Last year, as part of their unit on birds and wildlife habitat, the two fourth-grade classes heard presentations by members of the local Audubon chapter on bird migration, bird feeding, and habitat requirements. The presentations stressed food, water, and cover as requirements for birds. The fourth grade classes began to discuss ways in which they could attract birds, and began to investigate the possibility of building nest boxes and feeding stations to be placed outside the classroom windows. Parents, the Audubon chapter, and the local hardware store got involved, resulting in the planning and construction of feeding stations, including bird baths with electric heaters. Since most of this work happened during winter and spring, the fourth graders were concerned about being able to watch their feeding stations in the Fall when they were fifth graders, so they constructed stations to be placed outside of the fifth grade rooms, as well.

This fall, as a way of extending their bird-feeding activities into the fifth grade, where the study of plants is a major focus, the local urban forester (also a local parent) was invited to speak to the classes about planning some planting projects that would improve the area for birds. We learned that the spruce and aspen windbreak was a positive landscape feature for birds, providing cover and nest sites, but that the lawn between the school and the windbreak provided no benefits to wildlife at all. The forester suggested that "clump and thicket" plantings of shrubs and trees would draw birds from the windbreak toward the feeding stations, and that if trees and shrubs were chosen for their food value, they could provide berries and other benefits to birds and other animals throughout the year. He also told us that our aspen trees were host trees to many butterfly larvae and other insects, and that hackberry trees were another excellent butterfly larval food source. He lent us a copy of the DNR publications *Landscaping for Wildlife* and *Wild About Birds* to help us in our research, and volunteered to be a resource for us as we planned our project.

The project we are planning involves planting hackberry trees and thickets of shrubs near the windbreak, and shrub clumps closer to the classrooms. We also want to plant a foundation planting of low shrubs under the classroom windows, between the building and the feeding stations. These shrubs will provide a variety of food, nest sites, and cover for birds and other wildlife, and will make it easier for birds to come to our feeding stations. We will also be able to investigate which birds like which shrubs, and observe a variety of bird behavior both at our feeders and in the plantings.

2b. List the different stages of the project and the major participants involved in each stage, including approximate dates for starting and completing each stage.

Fall, Year 1. Initial Research and Planning. Much of this has already been done. We asked the forester to help us compile a list of native shrubs that would benefit birds, including shrubs that form thickets and shrubs that would be good to plant in clumps. Fourth grade students study wildlife habitat, so several small groups looked each plant up in *Landscaping for Wildlife* and other reference books,;and looked for references to birds and animals that used that plant. Fifth-graders study plants, so groups of fifth graders collected information on each plant about its eventual size, sun requirements, how it spreads, and (since we also used the Outback Nursery catalog and lists of plants available from our Soil and Water Conservation District) how much each shrub or tree might cost at various sizes. A parent who is a Master Gardener helped the fifth-graders understand how shrubs are sold: in containers, bare-root, etc. With this information compiled on each of the plants on the forester's list, an after-school planning group consisting of several fourth graders, several fifth graders, two teachers, the Master Gardener parent, a custodian, and the forester came up with a preliminary plan (see map). The planning group met with the principal to get her support.

Winter, Year 1. When we find out whether we get the grant or not, the planning group will put together a plant order. We expect that we will order the trees and larger specimens of shrubs from a nursery that carries native plants, and we'll order smaller, bare-root plants through the Soil and Water Conservation District. If possible, we'll take a field trip to the Hennepin County Parks native tree nursery, so we can learn more about how trees and shrubs are grown for sale; if we can't do that, we'll arrange for a speaker from a tree nursery to come to us. After we find out what shrubs are available, we'll decide where to plant what, and begin to plan a spring work day.

Spring, Year 1. We'll have one or two work days to plant our trees and shrubs. We'll need to borrow tools like spades and planting bars, and arrange to water our new planting if it is dry. We'll have to determine where the maintenance people should mow and where they should not, and make sure the plantings are well-marked. We plan to have landscape cloth or tree mats around the plantings to keep weeds down.

Summer, Year 1. The custodial staff will water, and two teachers have volunteered to monitor the plantings a few times during the summer. Many students have said that they will also stop by, and can help water if necessary.

Fall, Year 2. We will need to wrap the trunks of the young trees to prevent sun damage in winter, and see whether we need to protect our plantings from rabbits. The new class of fifth graders, who study plants, will learn to identify the shrubs and trees and will measure their growth each fall, both height (using the shadow method), diameter, and spread of thickets. We will also keep a photographic record, and observe flowering-budding of leaves etc. each spring.

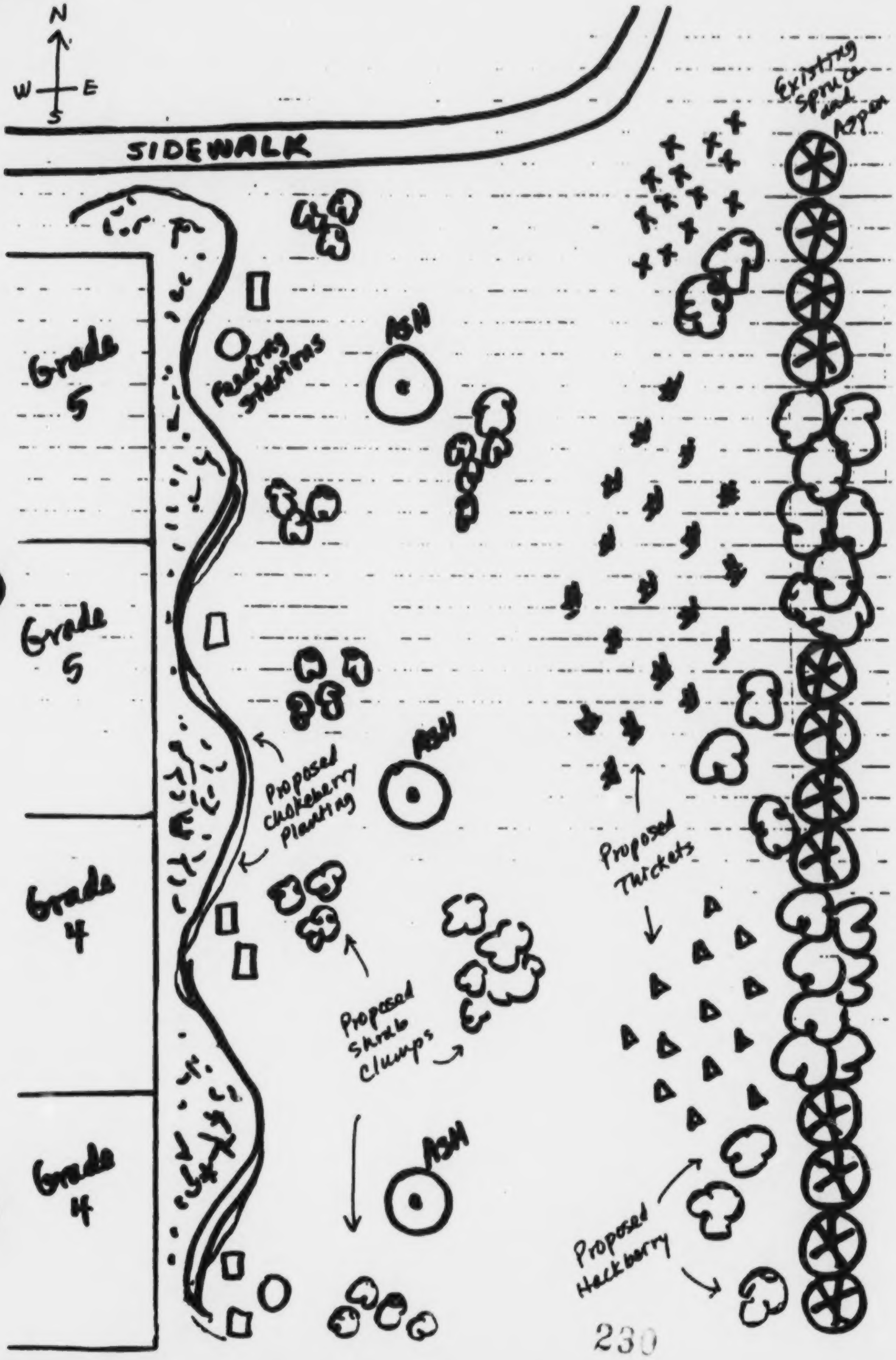
3. If your project includes plantings, list the native plants appropriate to your locale that will be used. If the project benefits wildlife, indicate species .

We will plant large and small shrubs in clumps, and establish some thickets using bare-root shrubs that sucker or spread by rhizomes. All produce fruits that birds eat and provide cover for birds and other animals; some are also larval plants for butterflies.

Trees: *Hackberry*, because it produces berries for the birds and supports Mourning Cloak, Comma, Question Mark and Hackberry Butterfly larvae.
Thicket-forming shrubs: We will choose several from among the following. *Chokecherry, American Plum, Red-Twig Dogwood, Gray Dogwood, Staghorn Sumac, Elderberry.*
Shrubs to plant in clumps: *Highbush cranberry, Nannyberry, Juneberry or Serviceberry, Pagoda dogwood, Red-Twig Dogwood.*
Low shrubs for foundation planting: *Black Chokeberry.* Provides berries and cover for birds.

SUNNY
MEADOWS
SCHOOL

Proposed Wildlife Planting Project


N
W
E
S
SIDEWALK
Existing Spruce and Aspen
Grade 5
Grade 5
Grade 4
Grade 4
Feeding Stations
ASH
ASH
ASH
Proposed Chokeberry Planting
Proposed Shrub Clumps
Proposed Thickets
Proposed Hackberry

Existing Features:
- Windbreak
- Ash Trees
- Feeding Stations

Proposed Features:
- Chokeberry plants
- Shrub Clumps
- Shrub Thickets
- Hackberry Trees

See proposal for shrub species detail.

Scale:
10 ft = ⊢—⊣

4. Map attached. 5. Not applicable. 6. Not applicable.

7. How have students been involved in the project's planning and design? How will they be involved in implementation and maintenance? What curricular connections will be developed?

Students have been involved in planning of this project from the beginning. (see Ques. 1 and 2.) Small cooperative groups of students have worked on information-gathering, planning, publicity, resource location, contacting the principal and custodians, writing to suppliers, etc. The entire fourth and fifth grades will be involved in the work days for planting, and in observation and monitoring activities in subsequent years. We don't know exactly what maintenance activities will be needed after the first year, but as we monitor the project for wildlife activity, any necessary maintenance will be addressed. Additional curricular connections will be developed by the fourth/fifth grade teacher teams related to the major fourth grade focus on animal habitats and the fifth grade focus on plants; we expect to develop other related connections in the areas of careers, planning of additional projects, art and photography, development of a plant and animal field guide for the schoolyard, etc.

8. Provide a budget detailing expenses for the project.

Proposal Budget

Item	*Quantity*	*Cost each*	*Total cost*
Trees (large, container-grown) Hackberry	8	$35.	$280
Shrubs (large, container-grown) Highbush cranberry, Nannyberry, Juneberry, Elderberry, Pagoda Dogwood	15	$10	$150
Shrubs (medium, container-grown) Red-Twig Dogwood	15	$5	$75
Shrubs (small, bare-root) Black Chokeberry, Chokecherry, American Plum, Red-Twig Dogwood, Gray Dogwood, Staghorn Sumac	200	$1	$200
Tree mats/landscape fabric; staples			$200
Tree wrap or shelters (for trees, larger shrubs)			$40
Reference books Landscaping for Wildlife, 2 copies			$25
Total			**$970**

Note: Prices are based on Outback Nursery catalog (wholesale), Schumacher's Berry Farm price list, and Rice County Soil and Water Conservation District price list.

THE SCHOOL NATURE AREA PROJECT ENVIRONMENTAL ACTION GRANTS

1997-98

Partnership
GRANTS
FOR MINNESOTA SCHOOLS

New Partnership Grant Program Offers A Three Year Commitment to Schools
Any K-12 public or private school may apply, including those schools who have previously been awarded SNAP Partnership and Project grants.

Partnership Grant Summary

We have revised our Partnership program to better serve schools by providing a broader variety of support services and teacher opportunities over a longer time period.

Our new program offers:

- Three years of assistance
- SNAP staff at Regional Centers: Northfield, Cloquet, and in 1998, Collegeville
- Ecological education with a focus on Minnesota biomes
- Environmental education training
- Site development assistance
- Teaching strategies applied to inquiry
- Assistance with implementation of Minnesota Graduation Standards
- Assistance with technology applications
- Leadership training
- Strategic planning for nature area and curriculum
- Community involvement

Highlights of the program:

YEAR ONE

- A week-long August workshop for teachers at the regional centers
- Three weekend meetings at regional centers in October, April, and June
- A community weekend at an ELC in January

YEARS TWO AND THREE

- Topical workshops at the school for faculty and community
- SNAP Site visits to assist with strategic planning and implementation

SNAP Project Grants

SNAP also offers Project grants for teachers and their students who are interested in doing a specific project that enhances native vegetation and wildlife habitat. Individual classrooms, a combination of classrooms, or an entire school may apply for Project grants. These grants are for a one-year period. Call 507-646-3599 to request a Project grant application. Project grants must be postmarked by December 9, 1996.

Application Deadline: Jan. 15, 1997

Partnership Grant Components

SNAP Partnership grants include the following:

- SNAP personnel, including a Regional SNAP Educator, a Site Specialist, and a Technology Specialist, to provide instruction and assist with site and curriculum planning and implementation.
- Room and board for Core Teams and Expanded Teams at an August week-long workshop, and weekend meetings.
- Room and board for nine (9) community members at January community weekend.
- $500 stipend for Core Team members.
- $3000 in implementation funds for site and curriculum resources.
- Graduate credit for Core Team members.
- Seven topical workshops throughout Years two and three for faculty and/or community members.
- Continuing education credits for Topical Workshops
- Schools and teachers will learn about methods of self evaluation. A program evaluator will conduct ecological literacy assessments, visit schools and conduct interviews to monitor progress and help insure your school's program success.

Resources Core Teams will receive as a part of Year 1 in-service workshops:

Minnesota's Natural Heritage: An Ecological Perspective
by John R. Tester

School Nature Areas: Benefiting the Biomes
by SNAP

Prairie Restoration for Wisconsin Schools
by Molly Fifield Murray

A Guide to Curriculum Planning in Environmental Education
by David Engleson and Dennis Yockers

Environmental Education in the Schools: Creating a Program that Works
by Judy A. Braus and David Wood

Eco-Inquiry
by Kathleen Hogan

Perspectives of Hands-On Science Teaching
by David L. Haury

Building Common Ground: Environmental Leadership
by Susan Halbert and Jean Hovey

School Requirements

- Schools must have a suitable site for a nature area within easy walking distance of their building, or clearly show that adequate transportation and class time are available for nature area trips on a regular basis.
- Six teachers will form a Core Team to attend all in-service training in Year 1 and to facilitate strategic planning and implementation throughout Years 2 and 3.
- Designate one (1) Core Team member to be a Team Leader. Responsibilities include coordinating meeting dates at the school, collecting data for annual reports on items such as nature area use and community involvement, completing annual reports with the Regional SNAP Educator, and overseeing the program budget.
- Support the Core and Expanded Teams with transportation or mileage reimbursement.
- Schools will provide the equivalent of 2-3 days of release time or compensation each year for Core Team members. Experience has shown us that time is the most important factor in deciding the success of a program. Core Team members need the support of the school administration for time to work on various components of the grant. Some time may be for Core Team meetings; some time will be needed for individuals or small groups to work. The team and school administration will work together to discern the means for work time which could include during or out-of-school hours.
- Formation of an Expanded Team during Year 1 to include school administration (administrative personnel or a school board member), students, and community members.
- Annual Reports documenting nature area use, site and curriculum planning, and implementation.

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Partnership Grant Timeline

January 15, 1997	Applications must be postmarked to SNAP.
February – March	Site visits to finalist schools. We will meet the Core Team and principal, and visit the nature area site.
April, 1997	Schools will be notified of selection.
	Call (507) 646-3599 with questions.

Program Description

In-service Training

The school Core Team will participate in four in-service workshops that focus on ecology, environmental education, using teaching strategies applied to inquiry, technology applications, leadership training, and strategic planning. Workshops will be held at the Regional Center and will incorporate field trips, guest speakers, and classroom applications.

1. *August Ecology Week*

   August 3-8, 1997: Cloquet Forestry Center
   Northern Region.
   August 10-15, 1997: St. Olaf College, Northfield
   Southern Region

   The dividing line between northern and southern regions is based on several factors including geographic location and biome types. The school principal will attend the "principal day" during the week.

2. *October Leadership Weekend* (dates to be determined)
   Friday evening through Saturday afternoon.
   Main focus on leadership development.

3. *April Curriculum Weekend* (dates to be determined)
   Friday evening through Saturday afternoon.
   Main focus on curriculum assessment.

4. *June Strategic Planning Weekend* (dates to be determined)
   All day Friday through Saturday afternoon.
   Core Team meets all day Friday.
   Expanded Team joins them for all day Saturday.
   Main focus is preparation for school-wide strategic planning

January Community Weekend (dates to be determined)

Each Core Team and approximately nine community members will attend a Friday evening through Sunday afternoon workshop at an environmental learning center. The weekend will involve brainstorming ways that individuals, organizations, companies, and agencies can assist with the school nature area and environmental education. Families are welcome to attend and special family activities will be provided.

Topical Workshops

In Years 2 and 3, schools select workshops to be offered to the Expanded Team, faculty or community. Approximately seven workshops may be offered on topics such as creating electronic nature area guides, EE through children's literature, geology and the nature area, Minnesota Graduation Standards and the nature area, nature area planning and management issues, and Internet based projects.

Strategic Planning Meetings

The Core and Expanded Team will coordinate strategic planning efforts for the nature area and curriculum. Regional SNAP Educators will help facilitate strategic planning.

Technology Applications

Throughout the three-year grant period, SNAP will assist schools with incorporating technology into ecology and environmental education instruction. A variety of software packages will be reviewed. Teachers will gain sufficient familiarity to use e-mail, listservs, and the World Wide Web. They will gain skills to participate in Internet based projects and will review a variety of software packages.

Nature Area Projects

The Core and Expanded Team will coordinate nature area assessment and implementation of site projects. Activities such as planting native vegetation, wetland restoration, nest box placement, and site access, are examples of projects.

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Application Questions

Answer the following questions on separate paper. Responses must be typed and numbered. Send the original and two copies of your responses and the application cover page to SNAP, postmarked by January 15, 1997. Please make copies two sided if possible.

1. Why is your school applying for this grant? Speak specifically to your school's interest in integrating ecological and environmental education into the school curriculum. What roles will strategic planning and leadership training play to accomplish your goals?

   Partnership schools whom SNAP has worked with in the past should specify ways that they envision continued work with SNAP.

2. Our experience has shown that time to work on project related tasks is an important factor for project success. Describe how your school will meet the minimum requirement of 2-3 days per year of release time or compensation for each Core Team member.

3a. List six teachers who will serve on the Core Team. Include the **name**, **grade** and **subject**, and **signature** of each teacher. Team members should represent a variety of grade levels and disciplines. If six teachers equal more than 50% of your school teaching staff, call the SNAP office to discuss Core Team size.

(An entire K-12 school building is welcome to apply on one application. We ask that your Core Team include twelve members, roughly six from K-6 and six from 7-12.)

3b. Describe why each individual was chosen for the Core Team.

4. List ways that your school currently uses environmental education and the nature area. Or, list ways you would like to use the nature area.

5. To the best of your ability describe your nature area including vegetation types (trees, shrubs, lawn, etc.) landscape features, and topography. Note the acreage and dimensions.

6. Provide a map of your nature area on an 8 1/2 x 11 sheet of paper. Note the location of the school building and mark significant landscape features such as vegetation types, ponds, and trails.

7a. List the site development or enhancement projects that you have already done on your site.

7b. What site development or enhancement projects would you like to do?

8. During Year 1, the Core Team will solicit additional people to serve on an Expanded Team, some of which are community members. How have community members, agencies, or organizations assisted your school in the past? In what ways do you envision specific groups or individuals assisting with future nature area use?

9. State the ownership of the nature area property. If the property is owned by someone other than the school, please include a signed letter from the owner agreeing to the school's use of the site as a nature area. Please specify for how long this use is granted.

10. If your nature area is not within walking distance of the school, answer the following questions:
    a. How far away is the nature area?
    b. Describe how student transportation to the site will be provided and in what frequency (weekly, monthly, etc.).
    c. Describe how sufficient class time will be made available for nature area trips.

The School Nature Area Project (SNAP)
St. Olaf College, 1520 St. Olaf Avenue, Northfield, Minnesota 55057
(507) 646-3599

THE SCHOOL NATURE AREA PROJECT ENVIRONMENTAL ACTION GRANTS

1997-98

Partnership GRANTS

FOR MINNESOTA SCHOOLS

Application Cover Page

SCHOOL NAME ______________________ DATE ______________

SCHOOL ADDRESS ______________________________________

CITY ____________ COUNTY ____________ STATE ________ ZIP ________

PHONE ____________ FAX ____________ E-MAIL ______________

THIS APPLICATION FOCUSES ON WORKING WITH THE ☐ ELEMENTARY ☐ MIDDLE ☐ HIGH SCHOOL MADE UP OF ______ TEACHERS AND ______ STUDENTS IN GRADES ________.

I agree to oversee this grant, including activities such as serving as a contact person for setting meeting dates, compiling reports and overseeing the budget.

CORE TEAM LEADER ____________ SIGNATURE ____________ POSITION ________ DATE ________

I have read and support this application. I agree to provide work time for Core Team members, to help facilitate faculty participation, and to assist the Core Team Leader in grant duties.

SCHOOL PRINCIPAL ____________ SIGNATURE ____________ DATE ________

HAS THIS SCHOOL APPLIED PREVIOUSLY FOR A PARTNERSHIP GRANT? ☐ YES ☐ NO

If you have questions, please call the SNAP office at 507-646-3599.

Send the original and two copies of this application cover page and answers to application questions to:
SNAP, St. Olaf College, 1520 St. Olaf Avenue, Northfield, MN 55057. Please make copies 2-sided, if possible.

Applications must be postmarked by January 15, 1997.

SUGGESTED
WILD SCHOOL SITE WORKSHOP
AGENDA

9:00-9:30 INTRODUCTION -
What is action?
List some actions kids take for the environment.
When do kids actually see the results of recycling, turning off the lights, carpooling, not running water when they brush their teeth, not littering, etc?
WILD school site gives kids, schools, communities a tangible action project; they will see results and benefits to wildlife as the area is used as an outdoor classroom and study site

9:30-10:00 food, water, shelter, space - the components of habitat that all wildlife needs for survival
limiting factors
carrying capacity
OH DEER illustrates these concepts nicely

10:00-10:30 MAPPING
maps convey all kinds of information
one of today's goals is to complete maps of your site
hand out a variety of different maps for participants to study
do some map practice activities listed in Project HOME
hand out some prizes for correctly answered questions
do TODALSIGss activity to emphasize the types of information that should be on the school site maps the group will create

10:30-10:45 break

10:45-12:00 SITE INVENTORY ACTIVITIES
Size of the school grounds
Wet and dry spots
High and low temperatures
Animal signs
Most common plants
Survival adaptations - seeds
Human safety devices
25 words
Colors and hues
Textural maps (create as the teams inventory)

(from Maine Project WILD Coordinator, Lisa Kane,
Department of Maine Fish and Wildlife)

Send teams of participants out on the school site to gather the information. (You may want to direct each team to investigate a different portion of the school property, and then combine the information gathered)

12:00-1:30 working lunch

CREATE THE SCHOOL SITE MAP & OVERLAYS

(tracing the different components of maps and assigning them to different overlays helps in overall map reading and understanding)

1st overlay - trace the building and parking lots from the base map
add the human safety devices you discovered from the inventory

2nd overlay - trace topography lines from base map and add soil types from soil survey booklet (free from county Soil Conservation Service offices)
add wet and dry spots from inventory
add high and low temperatures from inventory (microclimates)

3rd overlay - color existing vegetation from most common plants inventory using crayons or markers
create a color key to the map; add animal signs from the inventory

1:30-2:30 THE PROPOSED PROJECT

Using the Project HOME guide plus your own ideas, start the 4th tracing paper overlay-LIST THE FOLLOWING QUESTIONS:

Look at existing food, water, shelter and space - what must be added to your school site to supplement the existing habitat?
What wildlife species do you want to attract?
What are reasonable, attainable, successful projects that can be accomplished the first year of implementation?
How will the projects relate to and be used in your existing multidisciplinary curriculum and lesson planning?

Briefly, have each team share their plans and maps for the site. Make sure the above questions are answered in the plan or demonstrated on the maps!

2:30-3:00 FUNDING AND COMMUNITY SUPPORT

Some options - Kids as Planners, Master Gardeners, Coverts, Cooperative Extension, Soil Conservation Service, forest rangers and Urban foresters, local nurseries and landscape businesses, local garden clubs, Audubon chapters, service organizations, PTA and other school support organizations

Basically review the help and assistance options available to schools for their proposed projects; there will be a resource list in the back of Project HOME.

Try to direct participants' thoughts towards self-sufficiency, grant opportunities, and the usual methods of fund-raising for 'seed money' (bake sales, plant sales, car washes and the like).

3:00-3:30 PLANNING THE MAINTENANCE OF THE SCHOOL SITE

an effective project maintenance schedule includes creating:

* calendars -- seasonal, monthly, and even weekly

* tasks -- written as specifically as possible so someone new to the project could implement them

* the name of the person, class or group responsible for completing the task; include a space for initialing when the task is completed

This concept is elaborated upon quite extensively in Project HOME.

3:30-4:00 wrap up, certificates, evaluations

What subject and skill areas have been incorporated into this process?

Life Science: identifying plants and animals, studying living communities and ecological systems, monitoring change
Earth Science: studying soil characteristics, hydrologic cycles, and properties of water and ground water
Physical Science: applying concepts related to weather, climate, seasonal patterns
Mathematics: tallying species, mapping the site, graphing growth of vegetation, interpreting data
Language arts: developing and writing a plan, making oral reports, writing newspaper and newsletter articles, communicating with diverse groups
Social Studies: identifying historical uses of a site, engaging in the political process, working cooperatively with others
Art: developing site and textural maps and illustrations
Industrial Arts: applying appropriate technology in land use projects: building bird houses, making signs, developing trails

> Can you see ways of incorporating the integrated learning goals described in the Common Core of Learning into your school curriculum?

No matter the size of the group, the strength of the project is with the students. The students need to choose the project, decide that it matters, and plan each step. The project should literally be student-driven. You can counsel and guide, but this is a project which must come from the students' convictions.

WILD SCHOOL SITE WORKSHOP
Houlton, Maine
Thursday, September 7, 1995
9:30am - 3:00pm

9:30-9:45 INTRODUCTION -
What is action?

9:45-10:15 **food, water, shelter, space - the components of habitat that all wildlife needs for survival**
OH DEER!

10:15-11:00 MAPPING

11:00-12:00 SITE INVENTORY ACTIVITIES
Size of the school grounds
Wet and dry spots
High and low temperatures
Animal signs
Most common plants
Survival adaptations - seeds
Human safety devices
25 words
Colors and hues
Textural maps (create as the teams inventory)

WORKING LUNCH!!!!

12:00-1:00 CREATE THE SCHOOL SITE MAP & OVERLAYS

1st overlay - trace the building and parking lots from the base map
add the human safety devices you discovered from the inventory

2nd overlay - trace topography lines from base map and add soil types from soil survey booklet (free from county Soil Conservation Service offices)
add wet and dry spots from inventory
add high and low temperatures from inventory (microclimates)

3rd overlay - color existing vegetation from most common plants inventory using crayons or markers
create a color key to the map; add animal signs from the inventory

1:00-1:30 THE PROPOSED PROJECT
Using the Project HOME guide plus your own ideas, start the
4th tracing paper overlay - USE THE FOLLOWING QUESTIONS WHEN YOU GENERATE THIS OVERLAY:
***Look at existing food, water, shelter and space - what must be added to your school site to supplement the existing habitat?**
***What wildlife species do you want to attract?**

***What are reasonable, attainable, successful projects that can be accomplished the first year of implementation?**
***How will the projects relate to and be used in your existing multidisciplinary curriculum and lesson planning?**

1:30-2:00 Briefly, each team will share their plans and maps for the site. Make sure the above questions are answered in the plan or demonstrated on the maps!

FUNDING AND COMMUNITY SUPPORT
Some options - Kids as Planners, Master Gardeners, Coverts, Cooperative Extension, Soil Conservation Service, forest rangers and Urban foresters, local nurseries and landscape businesses, local garden clubs, Audubon chapters, service organizations, PTA and other school support organizations.

2:00-2:30 PLANNING THE MAINTENANCE OF THE SCHOOL SITE
an effective project maintenance schedule includes creating:
* calendars — seasonal, monthly, and even weekly
* tasks — written as specifically as possible so someone new to the project could implement
* the name of the person, class or group responsible for completing the task; include a space for initialing when the task is completed
This concept is elaborated upon quite extensively in **Project HOME.**

2:30-3:00 wrap up, certificates, evaluations
What subject and skill areas have been incorporated into this process?

Life Science: identifying plants and animals, studying living communities and ecological systems, monitoring change
Earth Science: studying soil characteristics, hydrologic cycles, and properties of water and ground water
Physical Science: applying concepts related to weather, climate, seasonal patterns
Mathematics: tallying species, mapping the site, graphing growth of vegetation, interpreting data
Language arts: developing and writing a plan, making oral reports, writing newspaper and newsletter articles, communicating with diverse groups
Social Studies: identifying historical uses of a site, engaging in the political process, working cooperatively with others
Art: developing site and textural maps and illustrations
Industrial Arts: applying appropriate technology in land use projects: building bird houses, making signs, developing trails

Can you see ways of incorporating the integrated learning goals described in the Common Core of Learning into your school curriculum?

No matter the size of the group, the strength of the project is with the students. The students need to choose the project, decide that it matters, and plan each step. The project should literally be student-driven. You can counsel and guide, but this is a project which must come from the students' convictions.

WILD SCHOOL SITE WORKSHOP
Central Elementary School
Thursday, August 24 1995
9:00am - 3:00pm

9:00-9:15	INTRODUCTION -
9:15-9:45	food, water, shelter, space - the components of habitat that all wildlife needs for survival
	OH DEER!
9:45-10:30	MAPPING
10:30-11:30	SITE INVENTORY ACTIVITIES Size of the school grounds Wet and dry spots High and low temperatures Animal signs Most common plants Survival adaptations - seeds Human safety devices 25 words Colors and hues Textural maps (create as the teams inventory)
11:30-12:30	CREATE THE SCHOOL SITE MAP & OVERLAYS

(tracing the different components of maps and assigning them to different overlays helps in overall map reading and understanding)

1st overlay - trace the building and parking lots from the base map
add the human safety devices you discovered from the inventory

2nd overlay - trace topography lines from base map and add soil types from soil survey booklet (free from county Soil Conservation Service offices)
add wet and dry spots from inventory
add high and low temperatures from inventory (microclimates)

3rd overlay - color existing vegetation from most common plants inventory using crayons or markers
create a color key to the map; add animal signs from the inventory

(from Maine Project WILD Coordinator, Lisa Kane, Department of Maine Fish and Wildlife)

WORKING LUNCH!!!!

12:30-1:30 **THE PROPOSED PROJECT**

Using the Project HOME guide plus your own ideas, start the 4th tracing paper overlay - USE THE FOLLOWING QUESTIONS:

Look at existing food, water, shelter and space - what must be added to your school site to supplement the existing habitat?
What wildlife species do you want to attract?
What are reasonable, attainable, successful projects that can be accomplished the first year of implementation?
How will the projects relate to and be used in your existing multidisciplinary curriculum and lesson planning?

1:30-2:00 Briefly, have each team share their plans and maps for the site. Make sure the above questions are answered in the plan or demonstrated on the maps!

FUNDING AND COMMUNITY SUPPORT

Some options - Kids as Planners, Master Gardeners, Coverts, Cooperative Extension, Soil Conservation Service, forest rangers and Urban foresters, local nurseries and landscape businesses, local garden clubs, Audubon chapters, service organizations, PTA and other school support organizations

2:00-2:30 PLANNING THE MAINTENANCE OF THE SCHOOL SITE

an effective project maintenance schedule includes creating:
* calendars -- seasonal, monthly, and even weekly
* tasks -- written as specifically as possible so someone new to the project could implement them
* the name of the person, class or group responsible for completing the task; include a space for initialing when the task is completed

This concept is elaborated upon quite extensively in Project HOME.

2:30-3:00 wrap up, certificates, evaluations

WILD School Sites Workshop
NJ Division of Fish, Game & Wildlife
October 9, 1995
North Plainfield HS

10:30	Welcome, purpose, expectations & overview of workshop

Goals:

- Foster a sense of stewardship for the school site and its wildlife among students & teachers
- motivate teachers and students to develop plans for habitat improvement on the school site
- provide tools and develop team process to enable teachers to take action with students

	Team building activities
10:45	Site discovery: soils, vegetation, wildlife that exists currently on the grounds
	Mapping the existing resources
12 Noon	Lunch
1:00 - 3:00 p.m.	Management plans: what are some possibilities, choosing and implementing projects
	Motivating and involving students
	Materials and resources
	Grants and community assistance

WILD HABITATS WORKSHOP
GREEN LANE PARK
AUGUST 1, 1995

SUMMARY

Facilitators: Theresa Alberici, Kevin Crilley
Participants: Classroom teachers: 26

This workshop took place at the Green Lane Park Environmental Education Center, adjacent to an elementary school. Green Lane Park has a variety of habitats, as well as a formal butterfly garden.

9:00-9:30 Introduction

Introductory Activity: Each participant was given a card indicating an animal, food item, water source, space or type of shelter. Participants divided into groups by matching animal with all of its needs. Allowed brief time for participants to meet each other, then each group introduced members and gave one fact about their animal. Went outside and did Habitat Lap Sit uniting all groups and discussing basic needs of wildlife, importance of arrangement, role of habitat.(10min)

Why WILD HABITATS?: Project WILD video followed by short discussion on what the Game Commission program is about. Looked at steps one might take to get started in improving site habitat, starting with inventory and mapping. (handouts) (20min.)

9:30-10:30 Tree ID/Biodiversity

Tree ID session (30 min.) Introduced basic tree id. using dichotomous key. Went outside. Participants identified trees and discussed each species role in a habitat.(handouts)

Biodiversity session (30 min.) Introduced the basic concepts of biodiversity, importance of vertical and horizontal diversity and stratification to wild animals and plants. Went over the layers in a vertically stratified area- canopy, understory, shrub layer, ground layer. Participants went outdoors and observed typical school yard area- mowed lawn, one or two trees. Compared this with area of trees, shrubs, grasses and wildflowers. Discussed abilities of the 2 areas to provide wildlife with food, water, and shelter and roles of plants (observed in area) in providing these basic needs. (handouts)

Note: The entire workshop was informal but, at this time, we split participants into 2 groups for even further informality. Sessions were repeated. We based our discussions on the knowledge of the participants. Took a brief informal poll as participants registered and in the beginning of workshop. Tree I.D. was presented as a separate session due to interest/need of participants.

10:30-10:45 Break

(from Pennsylvania Project WILD Coordinator, Theresa Alberici, Pennsylvania Game Commission)

10:45-11:45 Inventory and mapping

Went over inventory and mapping task cards, showed example of a map. Participants were divided into groups (used animal groups from introductory session). Each group was responsible for mapping a given area. Within each group participants performed different tasks. This session took place in the elementary schoolyard adjacent to the workshop site.

11:44-12:30 Lunch (Participants were asked to bring a lunch)

12:30-1:30 Improving Habitat for Butterflies

This included a slide presentation on basic needs of butterflies-nectar plants, larva plants, water, sunning spot. Specific examples of nectar and larva plants were shown, as well as some butterflies typically found in the area. Participants then explored the butterfly garden located on site. Looked at "must have" plants for a formal garden. Session also included discussion about the uses of native and non-native plant species-pro/cons, appropriate/ non-appropriate uses. (handouts)

1:30-2:00 Attracting Birds and other Wildlife to School Sites.

This session concentrated on songbirds. Used a slide show to discuss year-round and migratory songbirds and how to meet their needs. Addressed specific food and cover plants, water sources, feeders, nest sites and nest boxes. Throughout session showed slides of different habitats, their arrangements and how they affected songbirds and other wildlife. Finished with slides of PA sites that were developed to attract songbirds. (handouts)

2:00-2:45 Plan a WILD Habitat

Participants returned to their mapping groups and were asked to improve their map sites for wildlife. Improvements were placed directly on map. Presented "before" and "after" to other groups.

2:45-3:00 Wrap-up

Summarized how planning, developing and using WILD HABITAT sites would fit into their curriculum, reiterated the importance of student participation in all aspects of planning and implementation, and the importance of administrative, groundskeeper, and parent support. Answered questions such as "Where to get funding?"-WILD ACTION Grants/ DER grants, WalMart, PTA, etc. (Although this appears to be a short time to do all of this, these topics were addressed throughout the day by being incorporated into the video, slide shows, mapping and site development sessions.)

3:00 Evaluations

WILD HABITATS WORKSHOP

GREEN LANE PARK
AUGUST 1, 1995

9:00-9:30	Introduction
9:30-10:30	Tree ID; Biodiversity ½ hour repeated sessions: participants break into 2 groups
10:30-10:45	***Break***
10:45-11:45	Participants work in groups to survey and map a given area
11:45-12:30	***Lunch***
12:30-1:30	Improving habitat for butterflies
1:30-2:00	Attracting birds and other wildlife to school sites
2:00-2:45	Plan a WILD Habitat
2:45-3:00	Closing and evaluations

Homes for Wildlife 5/6/96
Teacher Training Workshop, 6 hour format
New Hampshire Fish & Game Department
Coordinator: Marilyn C. Wyzga

Agenda

Part I

15 minute • Introduction
– Setting the tone; outlining the process: "This is the process you will take your students through."
– Teacher introductions
– Distribute both curriculum guides, 1 per grade level
– Present background on Project HOME inception, development, etc.

30 min • Schoolyards Activity: "Keep in mind food, water, cover and space and how they are arranged."
– Review concept of habitat, how it applies to humans and wildlife
– Activity gets them looking at schoolyard as both habitat and learning area; reinforces concept of habitat, how it relates to this project, how they will learn with/teach their students the concepts
– Work in small groups, then present/discuss in large group

45 min • The Process: "Now, what are the steps to make it happen?"
– Brainstorm in small groups: How will you proceed in carrying out a habitat enhancement project at your school? (refer to Master Plan on p. 26; Master Plan Overview on p. 20)
– Show MN video, "Learning Under the Sun: School Nature Areas"
– Large group discussion of video contents, plan and sequence of steps
– Discuss Enhancement Plans: What do we have? What do we want? How will we get it?

45 min • Team Building Exercise
– In small groups: In a separate room, an assembled bluebird box is displayed, along with all the parts to build. A member of each group looks at the box and collects the necessary parts. Another member of the group is blindfolded, and must assemble the box with only verbal instructions from the other group members.
• Team Discussion: "Based on where you are right now, who should be involved in your project?"
– In small groups, discuss: Who will be on your team? (refer to Team on p.22 and Team Worksheet in Appendix J)
(– In large group, list key team members and roles)

45 min • Mapping Concepts and Techniques

- Using samples of different kinds maps, discuss: What is a map?
- Show samples of each map type (aerial photo, site plan, soil map, etc.), refer to process in Chapter 3 using base map/overlays
- Childhood Maps exercise
- In pairs, discuss different approaches to mapping with students

Part II

30 min • Mapping and Inventory Preparation
- Using site plans of school, divide schoolyard into units; include a permanent structure like a wall or road in each for reference point
- In small groups, teachers lay-out a map of their section of the schoolyard to scale on 1" gridded chartpak paper – enlarging scale from original site plan
- Demonstrate technique of pacing to figure out length of pace
- Assign a species group to each teacher group: small mammals; game (galinaceous) birds; migrating and resident birds; cavity nesters; butterflies and hummingbirds; reptiles and amphibians

90 min • Mapping and Inventory Activity
- Provide each group with bucket of tools
- In same small groups, teachers conduct a site inventory of their section of the schoolyard, completing activity cards "Size of School Grounds", "Wet and Dry Spots", "Animal Signs", "Common Plants", "25 Words", and "Colors and Hues" from curriculum guide
- Groups prepare texture maps
- Groups suggest 3 project ideas for their section of the schoolyard, based on their assigned species group
- "Start with a project that doesn't require intensive study and mapping, like a bird feeding area with bath or wildflowers along a walkway; then develop the process of mapping and inventory that takes the time."

30 min • Mapping and Inventory – Follow-Up
- Group presentations of maps and project ideas
- Put maps together to make one map

30 min • Wrap-up and questions
• Evaluation

Key points:
- keep students at the heart of the project
- work with *your* schoolyard, what you have available
- use the tool/resources available
- use native plants
- keep records

National EE Advancement Project
(715) 346-4179
February 1996

Status of Comprehensive State Environmental Education Programs: Description and Breakdown by State

- **State EE Master Plan - 11 states**

  Arizona, Arkansas, Colorado, Kentucky, Massachusetts, Minnesota, New Jersey, North Carolina, Pennsylvania, Washington, and West Virginia.

  Definition: A comprehensive state plan whose purpose is to chart a course of action and to provide an implementation schedule for meeting state goals for EE. These plans set forth the goals and objectives for EE within the state and typically list who is best suited to achieve or implement these goals and objectives (e.g. the legislature, the business community, school administrators, etc.). They are created through input from a wide range of EE leaders, educators, legislators, state agency representatives, business representatives, and others.

- **State By-law or Requirement for K-12 Environmental Education Instruction - 12 states**

  Arkansas, California, Georgia, Illinois, Iowa, Louisiana, Maryland, Nevada, Ohio, Pennsylvania, Washington, and Wisconsin.

  Definition: Requirement that schools and K-12 teachers incorporate EE into their existing curriculum. This component is achieved through legislative or administrative avenues.

- **Coordinated Statewide Teacher Inservice Training in EE - 15 states**

  Alabama, Arkansas, Connecticut, Delaware, Georgia, Hawaii, Indiana, Iowa, Maryland, Minnesota, Nebraska, North Carolina, Oklahoma, Texas and Virginia.

  Definition: Teacher training that targets K-12 teachers and enables them to become fully competent to teach to all of the goals of EE. A coordinated system of inservice programs that makes EE training available to all teachers within a state and allows for professional development options in EE as well as credits to maintain teaching certification.

- **Required EE Training prior to Teacher Certification or Licensing - 3 states**

  Arizona, Delaware and Wisconsin

- *Definition:* EE preservice training required for teachers desiring to teach certain subjects or grade levels that provides instruction in and ensures competencies in environmental/ecological concepts, the range of instructional and assessment methodologies used with EE and effective approaches for infusing or inserting EE into the curriculum.

- **EE Curriculum Guide** or other state publication providing direction to the development of an EE program at the school district level - **15 states**

  Arkansas, California, Hawaii, Kansas, Louisiana, Minnesota, Nevada, New York, Ohio, South Carolina, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Definition: EE Curriculum Guides often include instructional strategies, resource listings and suggestions for developing curriculum. They assist in integrating EE into existing curriculum and helping with curriculum/school restructuring. EE Curriculum/Resource Guides sometimes have units and lessons for use by teachers and school districts.

- **State Environmental Education Learner Objectives/Outcomes - 17 states**

  Alabama, Arizona, Arkansas, Colorado, Delaware, Hawaii, Massachusetts, Maryland, Minnesota, Missouri, New Jersey, Ohio, Tennessee, Virginia, Washington, West Virginia, and Wyoming.

Definition: Objectives, Outcomes, Benchmarks, Essential Skills, etc. are intended to assist educators in developing specific instructional plans and assessment strategies for incorporating EE in given subject areas. These help ensure instructional consistency within academic disciplines among the state's schools and may be exit oriented or lesson oriented.

*Note: Within many of the states, the EE Learner Outcomes/Objectives, Benchmarks, Essential Skills, etc. are found within the science, geography, and social studies standards.

- **State Supported EE Grants Program - 21 states**

  Alabama, Arizona, Arkansas, California, Connecticut, Florida, Georgia, Iowa, Kentucky, Maryland, Massachusetts, Nebraska, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Virginia, and Wisconsin.

Definition: Grants program that uses state and/or private sector funds to increase EE programming at the grassroots level. EE grants programs are typically overseen by state offices for EE, state EE Boards or Advisory Councils and are accessible to both formal and nonformal education entities for enhancing or creating state and locally based EE projects.

- **State Assessment Program that includes EE - 3 states**

  Kansas, Maryland and New Hampshire

Definition: Application of assessment "tools" (including standardized testing, authentic/performance assessment measures and other evaluation methods) to determine the extent to which EE curriculum and instruction is having the desired impact on students.

- **State EE Board or Advisory Council - 22 states**

  Arizona, Arkansas, California, Delaware, Florida, Georgia, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, Texas, Washington, West Virginia, and Wisconsin.

Definition: State EE Boards or Advisory Councils are the policy making and implementation oversight bodies for many state EE programs. EE Boards/Councils include key representatives of sectors/constituencies supporting EE including school teachers and administrators, university and business representatives, legislators, state agency representatives, and leaders from nonprofit conservation organizations.

These entities often oversee implementation of an EE master plan's recommendations. Further it may also complete assessments of the status of EE statewide, continue to identify needs and set priorities for EE, consult with the Department of Education (or equivalent), Department of Natural Resources and other state agencies and offices about EE program priorities, complete regular reports to the legislature, oversee an EE grants program and solicit funds.

- **State EE Office - 16 states**

  Arizona, California, Colorado, Connecticut, Delaware, Florida, Iowa, Kentucky, Massachusetts, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, Tennessee, and Washington.

Definition: State office and staff with EE responsibilities such as the following: assess the status of environmental literacy; prepare an EE plan; staff the EE grants program; promote and assist in the development of EE learner outcomes; promote and aid in the development of EE preservice and inservice teacher training; cooperate with federal government, agencies and the private sector around EE programs; function as an EE clearinghouse; initiate, develop, implement, evaluate, and market nonformal EE programs; initiate research on EE; and coordinate EE conferences on a periodic basis.

- **State Level EE Centers and/or Regional Offices - 20 states**

  Arizona, Arkansas, Connecticut, Delaware, Florida, Kentucky, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Washington, and Wisconsin.

Definition: EE Center(s) whose primary goal is to assist educators and administrators throughout all levels of the education system in the incorporation of EE as required or recommended by the state legislature. Typical services include: inservice EE programs, assistance in infusing EE into district and school curriculum, resource libraries, school networking programs, and EE literacy assessment projects.

- **Interagency State EE Committee - 23 states**

  Alabama, Arkansas, California, Connecticut, Florida, Hawaii, Illinois, Indiana, Kentucky, Louisiana, Maine, Massachusetts, Minnesota, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, Washington, and Wisconsin.

Definition: Committee of state agency representatives (sometimes include Federal agency representatives with state offices) which work to eliminate overlap in EE programs and to leverage their resources for greater impact.

- **State EE Association - 45 states**

  Alabama, Alaska, Arizona, Arkansas, Colorado, Connecticut, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Definition: Non-profit, professional grassroots organization whose members typically include teachers, agency and nature center professionals, college students and community educators as well as organizational members such as colleges and universities, school districts, environmental groups, businesses and county, state and federal agencies. This organization helps support and implement EE programming as well as providing members with networking opportunities, professional development and communication about EE concerns.

- **Computerized Networking System for EE Materials and Services - 11 states**

  Arizona, Florida, Hawaii, Kentucky, Massachusetts, North Carolina, Ohio, Texas, Utah, Virginia, and Washington.

Definition: Computer network that provides educators and EE leaders with access to EE resources, events, funding opportunities and other helpful information.

- **Funding sources for EE - 24 states**

  Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Hawaii, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Montana, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Virginia, Washington, and Wisconsin.

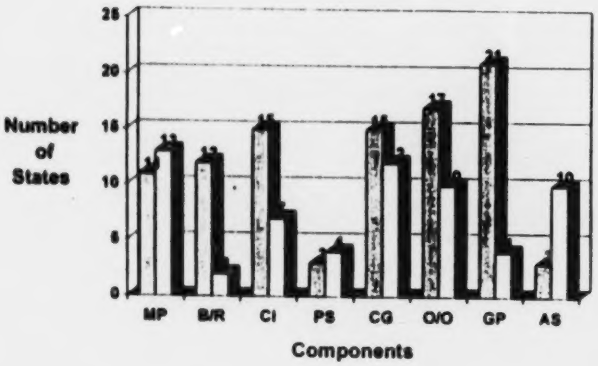
Definition: Source(s) of funding to support the state level EE program infrastructure and specific programs, such as an EE grants program. Can be provided by a variety of means such as general revenue, license plate fees, resource user fees, polluter fines, taxes, lotteries and private donations and grants.

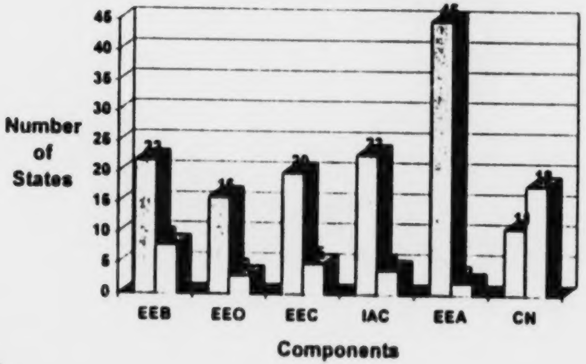
- **EE Trust Fund** for raising and supporting EE programs with both public and private dollars- **5 states**

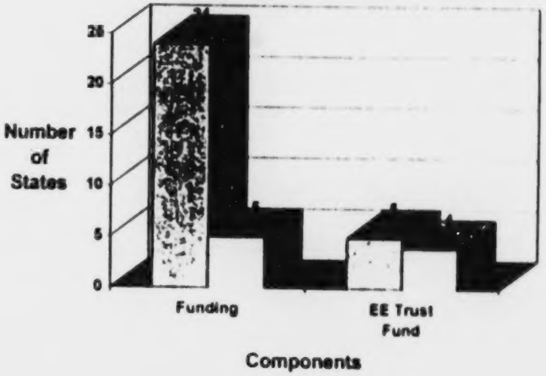
  Florida, Kentucky, Maryland, Massachusetts, and Texas

Definition: Mechanism for generating and disbursing financial resources for EE. Trust funds are a permanent fund enabling EE leaders to collect and spend both private (grants and donations) and/or government dollars.

1996 Status of State Level Environmental Education Programs


Program Components


Structure Components


Funding Components

Key: Abbreviations for Program and Structure Components

Program

- MP - State EE Master Plan
- B/R - By-law or Requirement for K-12 Instruction
- CI - Coordinated Inservice Training for Teachers
- PS - EE Training prior to Teacher Certification
- CG - State EE Curriculum Guide
- O/O - EE Learner Objectives or Outcomes
- GP - State Supported EE Grants Program
- AS - State Assessment that includes EE

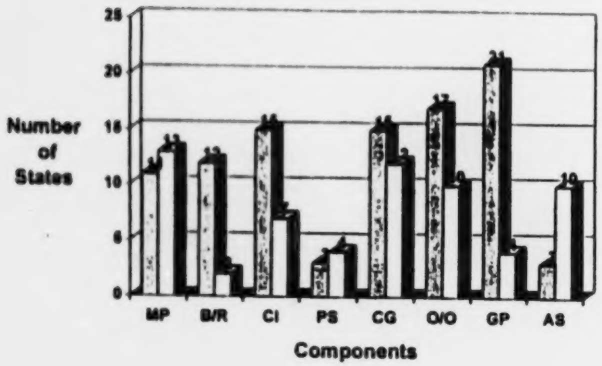
Structure

- EEB - EE Board or Advisory Council
- EEO - State EE Office
- EEC - State EE Centers and/or Regional Offices
- IAC - State EE Interagency Committee
- EEA - EE Association
- CN - Computer Networking System

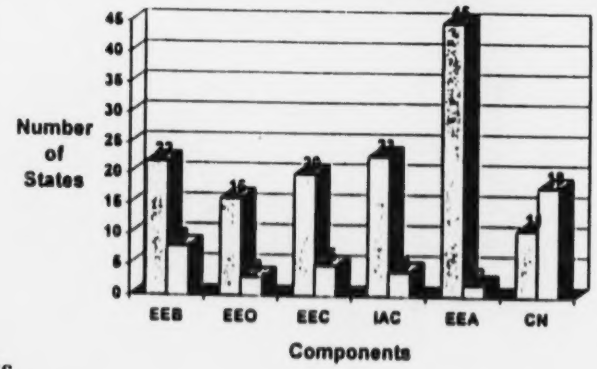
▨ In Place
☐ Developing

The National Environmental Educatio[illegible]vancement Project (715) 346-4179

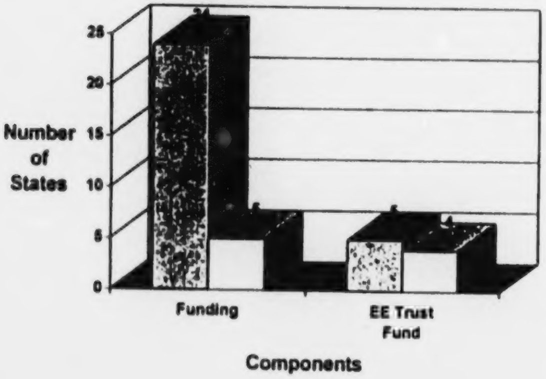
1996 Status of State Level Environmental Education Programs



Program Components



Structure Components



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▨ In Place
☐ Developing

The National Environmental Education Advancement Project (715) 346-4179

Habitats For Learning

The following is the fifth in a series excerpted from **The Habitats for Learning Program.**

For a copy of the complete program contact: Ohio Department of Natural Resources, Division of Soil and Water Conservation, Environmental Education Section, 1939 Fountain Square Court, Bldg. E-2, Columbus, OH 43224, (614) 265-6868 or FAX (614) 262-2064.

Outdoor Learning Activity Ideas

Self-directed, small-group activities that embrace a discovery approach to learning should be integral parts of any outdoor teaching. When using habitats for learning, it is especially important to incorporate problem-solving and cooperative-learning skills into the instruction. These strategies engage the learners and provide rich learning opportunities.

Teachers can create new outdoor activities or use ideas already developed by others. The diversity of ideas described below give a hint of the vast possibilities. the first two ideas integrate lessons from a variety of subject areas. Those that follow offer numerous activities in science, social studies, language arts, art and music, and health and physical education.

These suggestions are general and not grade specific. They can easily be adapted for different ages, settings, and time considerations. Generally, the teaching ideas in each category progress from simple to more complex. In addition, they demonstrate how activities designed for habitats for learning meet the full range of learning objectives—knowledge, skills, attitudes and behavior—across the curriculum.

Integrated Topic Activity

Pioneer Living

Working in small groups, learners pretend they are pioneers living on the school grounds (i.e., the land without the school buildings) in the year 1750. Using only what they can find on the school grounds, they can choose to draw or describe how they would find something to use for one or more of the following:

- Writing tool
- Shelter
- Container to hold water
- Game, musical instrument, toy
- Warm clothing or blanket
- Gift
- Rope
- Medicine
- Food for a week
- Other

Integrated Learning Skills Activity

Hula Hoop Plot Study

Learners form groups. Each group tosses a hula hoop so that it stops in an interesting part of the school grounds. The area inside the hoop determines the spot learners investigate. The groups should then:

- Observe the diversity of things they find within their hula hoop.
- Measure and count everything they find (or selected objects).
- Record their observations by drawing, labeling, graphing, and/or describing everything (or the most interesting things they find).
- Categorize and analyze their findings.
- Draw conclusions.
- Hypothesize about how different things are interrelated.
- Communicate their findings to other groups and compare similarities and differences.
- Predict what they would find if they tossed another hula hoop.

Learners then imagine that they are something that they found in their hoop and write a story describing one day in that item's life.

Nonpoint Pollution Mini-grants

The ODNR Division of Soil and Water Conservation announced in June the availability of Citizen Action Mini-Grants to protect valuable water resources. Lawrence G. Vance, Chief, says that his Division is very proud of the program because of its potential to help people in Ohio reduce nonpoint sources of water pollution.

Nonpoint source (NPS) pollution adversely affects over 13,000 miles of Ohio's perennial flowing streams. This includes sediment, fertilizers, pesticides, road salt, litter, heavy metals, brine, tree and permanent vegetation loss along streams and other pollutants/activites from both urban and rural land uses. While main tributary streams are impacted, headwaters to these streams are usually affected the most. This NPS pollution not only reduces the qualtiy of the water to support aquatic life, but also affects many public uses like recreation, water supply and aesthetic values. Ohio streams, lakes, wetlands and ground waters are all affected by NPS pollution.

"Since government cannot manage all of Ohio's 61,532 miles of streams and other water resources, we rely on citizens to help address NPS pollution," says Vance. "We have developed this Citizen Action Mini-Grant program to provide small amounts of money for local water resource improvement." According to Vance, stream and lake cleanups, stream habitat restoration, riparian tree planting, community storm drain stenciling and other activities generally qualify for funding.

County Soil and Water Conservation District offices may provide information about the program or contact: Dan Kush or John Mathews, in the Columbus office at (614) 265-6610.

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ACTION PROGRAM PLANNING AND EVALUATION

BENNETTS HEIRARCHY

	Program Plan Elements	Evaluating Program Elements
7. END RESULT **Ultimate objectives: side effects**		
6. PRACTICE CHANGE **Individual innovation** **Structural Change**		
5. KASA CHANGE **Direction and Extent** **Duration of Change**		
4. REACTIONS **Interest in Activities** **Acceptance of Leadership**		
3. PEOPLE INVOLVEMENT **Number and Characteristics** **Continuity and Intensity**		
2. ACTIVITIES **Educational Methodology** **Subject Matter Conveyed**		
1. INPUTS **Time expended** **Staff qualifications**		

from Margaret Tudor, Project WILD Coordinator, Washington state

School: North Tapp Middle School

SCORING GUIDE/RUBRIC FOR MODEL LINKS ENVIRONMENTAL PROGRAM

Model Links Goals/Products	Scale			
Traits	4 Success	3 Proficient	2 Beginner	1 Novice
Strategic Plan (School) #1	A strategic plan to use EE to meet Goal I EARLS has been completed; all goals accepted by school.	strategic plan for EE goals mostly completed	Initial planning done at school level; elements for the strategic plan identified; introduced to whole school.	Introduced to EE and EARLS
Student Learning Assessment Plan #2	All selected authentic assessments implemented	Most of the selected authentic assessment implemented.	Some of the selected authentic assessment implemented.	Attended Model Links workshops; emerging understanding of authentic assessments.
Teacher-training Mentors #3	A school team is scheduled to offer a workshop; the workshop planning completed.	Most workshop planning completed; (course description, plan of activities outlined); presenters selected, materials almost ready.	Piloted one mentor	Trained in mentoring; prospective mentors selected
Environmental Projects #4	All environmental projects completed.	Half or more EE projects completed	Environmental project(s) partially completed; some community contacts in place; some materials, transportation and equipment lined up.	Brainstormed EE projects for site
Dissemination of Information #8	Article for a journal publication completed; WWW Page ready; conf. presentation secured; video or parent newsletter completed.	Article completed, other projects in progress	Tentative plan for communication established	Initial planning meeting(s) scheduled; some materials identified.

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Schoolyard Habitat Facilitator Training
Hemlocks Conference Center, Hebron, CT
Jerry Schierloh: New Jersey School of Conservation, Montclair State University
September 26-27, 1995

WHAT TEACHERS NEED MOST

TO ENCOURAGE THEIR INVOLVEMENT IN SCHOOL-SITE HABITAT PROJECTS

A. INTERPRETATIONS AND UNDERSTANDINGS

Recognition and interpretation of school-sites as habitat teaching/learning environments

Understanding of the potential of school-sites as mini-communities and habitat life-support systems

B. GUIDELINES AND SKILLS (through repetitive training activities)

Site habitat inventory guidelines

Site habitat inventory practice skills

Site habitat instructional materials

Site habitat theme recognition strategies

Site habitat activities/issues correlations

Site habitat curriculum infusion models

Site habitat-use planning strategies

Site habitat management strategies/techniques

Site habitat sources of materials and technical expertise

C. SUPPORT AND ENCOURAGMENT

Administration backing and support (of school-site habitat use/projects)

Habitat site-use support group or committee

Exposure to habitat site-use "success stories" (good examples of habitat site use/development/enhancement projects)

MONTCLAIR STATE UNIVERSITY
NEW JERSEY SCHOOL OF CONSERVATION
Branchville, New Jersey

STUMBLING BLOCKS: OUTDOOR SITE UTILIZATION

The following is a list of "stumbling blocks" which typically prevent a school from making full use of its outdoor school-site for environmental studies activities. Try to RANK these factors in the order that seems to reflect the situation at your school (e.g., No. 1 - most serious stumbling block). You may wish to note other factors not covered on this list.

☐ Conflicting ideas or attitudes among teachers and/or administrators over how best to utilize the outdoor school site.

☐ Difficulty in maintaining features or structures used as a part of instructional activities.

☐ Discouragement due to past failures in school-site utilization.

☐ Lack of control of site during off-school hours.

☐ Lack of overall philosophy of use by the total school staff (e.g. administrators, teachers, maintenance, etc.).

☐ Lack of current relevant curricular guides/curricular planning materials that relate to outdoor school-site use.

☐ Majority of teachers feeling "unqualified" to teach in outdoor situations.

☐ Numerous outdoor school-site activities already taking place, but seeming to arise haphazardly and with little correlation among the site-use teachers.

☐ Potential conflicts in site-use with local landowners/surrounding residents.

☐ Pressure to prevent site use due to safety concerns and/or liability hazards.

☐ Problems due to conducting school-site activities due to class size or class time restrictions.

☐ Seeming lack of funds to properly equip site or its utilization.

☐ Perceived lack of potential of site for worthwhile teaching/learning situations.

☐ Seeming lack of curriculum time to work outdoor school-site activities into an already crowded teaching schedule.

☐ Uncertainties about how to adapt or alter a school-site area to improve it as a teaching/learning environment.

☐ Unenthusiastic support or encouragement by school administrators.

THE NETWORK of NATURAL HERITAGE PROGRAMS and CONSERVATION DATA CENTERS

...provide accurate and accessible biodiversity information necessary for making informed decisions concerning conservation, natural resource management, and development planning... These programs collect, continually update, analyze, and disseminate information about the location, condition, status, and trends of species and ecological communities.

STATE NATURAL HERITAGE PROGRAMS:

Alabama Natural Heritage Section
Dept Conservation & Natural Res.
Division of Lands
Folsom Administration Bldg..
64 N. Union Street, Rm 421
Montgomery, AL 36130
ph (205) 242-3484

Alaska Natural Heritage Program
707 A Street, Suite 208
Anchorage, AK 99501
ph (907) 257-2702

Arizona Heritage Data
Management System
Arizona Game & Fish Dept, WM-H
2221 W. Greenway Road
Phoenix, AZ 85023
ph (602) 789-3612

Arkansas Nat. Heritage Commiss.
Suite 1500, Tower Building
323 Center Street
Little Rock, AR 72201
ph (501) 324-9150

California Natural Heritage Div.
Department of Fish & Game
1220 S Street
Sacramento, CA 95814
ph (916) 322-2493

Colorado Natural Heritage Prog.
College of Natural Resources
Colorado State University
103 Natural Resources Building
Fort Collins, CO 80523
ph (303) 491-1309

Connecticut Natural Diversity Database
Natural Resources Center
Dept of Environmental Protection
79 Elm Street
P.O. Box 5066
Hartford, CT 06106-5127
ph (203) 424-3540

Delaware Natural Heritage Prog.
Division of Fish & Wildlife
4876 Hay Point Landing Rd.
Smyrna, DE 19977
ph (302) 653-2880

Delaware Nature Society
ph (302) 239-2334

District of Columbia Natural
Heritage Program
13025 Riley's Lock Road
Poolesville, MD 20837
ph (301) 427-1354

Florida Natural Areas Inventory
1018 Thomasville Road
Suite 200-C
Tallahassee, FL 32303
ph (904) 224-8207

Florida Native Plant Society
P.O. Box 6116
Spring Hill, FL 32868
(407) 856-2366

Georgia Natural Heritage Program
Wildlife Resources Division
Georgia Dept of Natural Resources
2117 U.S. Highway 278 S.E.
Social Circle, GA 30279
ph (706) 557-3032

Hawaii Natural Heritage Program
~~The Nature Conservancy of Hawaii~~
1116 Smith Street, Suite 201
Honolulu, HI 96817
ph (808) 537-4508

Idaho Conservation Data Center
Department of Fish & Game
600 South Walnut Street, Box 25
Boise, ID 83707
ph (208) 334-3402

Illinois Natural Heritage Division
Department of Conservation
524 South 2nd Street
Springfield, IL 62706
ph (217) 785-8774

Indiana Nat. Heritage Data
Center
Division of Nature Preserves
Department of Natural Resources
402 W. Washington St., Rm
W267
Indianapolis, IN 46204
ph (317) 232-4052

Iowa Natural Areas Inventory
Dept of Natural Resources,
Bureau of Preserves & Ecological
Services
Wallace State Office Building
Des Moines, IA 50319
ph (515) 281-8524

Kansas Nat. Heritage Inventory
Kansas Biological Survey
2041 Constant Avenue
Lawrence, KS 66047-2906
ph (913) 864-3453

Kentucky Nat. Heritage Program
Kentucky State Nature Preserves
Commission
801 Schenkel Lane
Frankfort, KY 40601
ph (502) 573-2886

Louisiana Natural Heritage Prog
Dept of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000
ph (504) 765-2821

Maine Natural Areas Program
Dept Economic/ Community Dev.
93 State House Station
Augusta, ME 04333
ph (207) 287-8044

Maryland Natural Heritage Prog
Department of Natural Resources
Tawes State Office Building, E-1
Annapolis, MD 21401
ph (410) 974-3195

Massachusetts Natural Heritage &
Endangered Species Program
Division of Fisheries & Wildlife
100 Cambridge Street
Boston, MA 02202
ph (508) 727-9194

Michigan Natural Features Inventory
Mason Building, 5th Floor
Box 30444
Lansing, MI 48909-7944
ph (517) 373-1552

Minnesota Natural Heritage &
Nongame Research
Department of Natural Resources
500 Lafayette Road, Box 7
St. Paul, MN 55155
ph (612) 296-3344

Mississippi Nat. Heritage Prog
Museum of Natural Science
111 North Jefferson Street
Jackson, MS 39201-2897
ph (601) 354-7303

Missouri Nat. Heritage Database
Missouri Dept of Conservation
P.O. Box 180
Jefferson City, MO 65102
ph (314) 751-4115

Montana Natural Heritage Prog.
State Library Building
1515 E. 6th Avenue
Helena, MT 59620
ph (406) 444-3009

Nebraska Natural Heritage Prog.
Game and Parks Commission
2200 North 33rd Street
P.O. Box 30370
Lincoln, NE 68503
ph (402) 471-5421

Nevada Natural Heritage Program
Dept Conservation & Natural Res.
1550 E. College Parkway, Ste 145
Carson City, NV 89710
ph (702) 687-4245

New Hampshire Nat. Her. Inventory
Dept Resources & Economic Dev.
172 Pembroke Street
P.O. Box 1856
Concord, NH 03302
ph (603) 271-3623

New Jersey Nat. Heritage Prog.
Ofc of Natural Lands Managemt
22 South Clinton Avenue, CN404
Trenton, NJ 08625-0404
ph (609) 984-1339

New Mexico Nat. Heritage Prog.
University of New Mexico
2500 Yale Blvd, SE, Suite 100
Albuquerque, NM 87131-1091
ph (505) 277-1991

New York Natural Heritage Prog.
Dept of Envi'l Conservation
700 Troy-Schenectady Road
Latham, NY 12110-2400
ph (518) 783-3932

North Carolina Heritage Program
NC Dept of Environment, Health &
Nat. Resources/ Div. Parks & Rec.
P.O. Box 27687
Raleigh, NC 27611
ph (919) 733-7701

North Dakota Nat. Heritage Inventory
ND Parks & Recreation Dept
1835 Bismarck Expressway
Bismarck, ND 58504
ph (701) 328-5357

Ohio Natural Heritage Program
Divi. of Natural Areas & Preserves
Department of Natural Resources
Fountain Square, Building F
Columbus, OH 43224
ph (614) 265-6453

Oklahoma Nat. Heritage Inventory
Oklahoma Biological Survey
111 East Chesapeake Street
University of Oklahoma
Norman, OK 73019-0575
ph (405) 325-1985

Oregon Natural Heritage Program
Oregon Field Office
1205 NW 25th Avenue
Portland, OR 97210
ph (503) 229-5078

Pennsylvania Nat. Diversity Inventory
PNDI-East
The Nature Conservancy
34 Airport Drive
Middletown, PA 17057
ph (717) 948-3962

Pennsylvania Nat. Diversity Inventory
PNDI-West
Western PA Conservancy
Natural Areas Program
316 Fourth Avenue
Pittsburgh, PA 15222
ph (412) 288-2777

Pennsylvania Nat. Diversity Inventory
PNDI-Central
Bureau of Forestry
P.O. Box 8552
Harrisburg, PA 17105-8552
ph (717) 783-0388

Rhode Island Heritage Program
Dept of Envi'l Management
Div. of Planning & Development
83 Park Street
Providence, RI 02903
ph (401) 277-2776

South Carolina Heritage Trust
SC Wildlife & Marine Res. Dept.
P.O. Box 167
Columbia, SC 29202
ph (803) 734-3893

South Dakota Nat Her. Database
SD Dept of Game, Fish & Parks
Wildlife Division
523 E. Capitol Avenue
Pierre, SD 57501-3182
ph (605) 773-4227

Tennessee Department of
Environment & Conservation
Ecological Services Division
401 Church Street
Life and Casualty Tower, 8th Fl
Nashville, TN 37243-0447
ph (615) 532-0431

Texas Parks and Wildlife Dept
Endangered Resources Branch
3000 IH-35 South, Suite 100
Austin, TX 78704
ph (512) 912-7011

Texas Native Plant Society
ph (512) 863-9685

Utah Natural Heritage Program
Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116
ph (801) 538-5511

Vermont Nongame & Natural
Heritage Program
VT Fish & Wildlife Department
103 S. Main Street
Waterbury, VT 05671-0501
ph (802) 241-3700

Virginia Div. of Natural Heritage
Dept Conservation & Recreation
Main Street Station
1500 E. Main Street, Suite 312
Richmond, VA 23219
ph (804) 786-7951

Washington Nat. Heritage Prog.
Department of Natural Resources
P.O. Box 47016
Olympia, WA 98504-7016
ph (360) 902-1340

West Virginia Nat Heritage Prog
Department of Natural Resources
Operations Center
Ward Road, P.O. Box 67
Elkins, WV 26241
ph (304) 637-0245

Wisconsin Natural Heritage Prog
Endangered Resources/4
Department of Natural Resources
101 S. Webster Street, Box 7921
Madison, WI 53707
ph (608) 266-7012

Wyoming Natural Diversity Database
1604 Grand Avenue, Suite 2
Laramie, WY 82070
ph (307) 745-5026

REGIONAL/ OTHER NATURAL HERITAGE DATA CENTERS:

Navajo Natural Heritage Program
Navajo Fish & Wildlife
P.O. Box 1480
Window Rock, AZ 86515-1480
ph (602) 871-6472

TVA Regional Heritage
River Basin Operations
Wildlife & Natural Heritage
Resources
Norris, TN 37828
ph (615) 632-1593

Blue Ridge Parkway
700 Northwestern Plaza
Asheville, NC 28801
ph (704) 259-0760

Everglades Research Center
Everglades National Park
P.O. Box 24918
Univ. of Miami Biology Department
Coral Gables, FL 33124
ph (305) 284-3013

Great Smoky Mtns National Park
c/o Janet Rock/ Keith Langdon
1314 Cherokee Orchard Road
Twin Creeks Nat. Resources Ctr.
Gatlinburg, TN 37738
ph (615) 436-1264

Gulf Islands National Seashore
1801 Gulf Breeze Parkway
Gulf Breeze, FL 32561
ph (904) 934-2605

Mammoth Cave National Park
Div of Science & Resource Mgmt
Mammoth Cave, KY 42259
ph (502) 758-2238

National Capital Region
Conservation Data Center
District of Columbia Nat. Her. Prog.
13025 Riley's Lock Road
Poolesville, MD 20837
ph (301) 427-1354

Greater Yellowstone
Conservation Data Center
P.O. Box 168
Yellowstone National Park, WY 82190
ph (307) 344-2157

Virginia Coast Reserve
The Nature Conservancy
P.O. Box 158
Brownsville Road
Nassawadox, VA 23413
ph (804) 442-3049

DATA NETWORK COOPERATORS:

Center for Plant Conservation
P.O. Box 299
St. Louis, MO 63166
ph (314) 577-9450
rare plants—

Flora of North America Project
Missouri Botanical Garden
P.O. Box 299
St. Louis, MO 63166
ph (314) 577-9550

Missouri Botanical Garden
P.O. Box 299
St. Louis, MO 63166
ph (314) 577-5180

International Plant Database
North Carolina Botanical Garden
Department of Biology-CB 3280
University of North Carolina
Chapel Hill, NC 27599
ph (919) 962-0578

more...→

This Network list is updated quarterly -- contact Hilary Toma (703) 841-5354.

CANADA

PROVINCIAL PROGRAMS:

British Columbia Conservation Data Center
Wildlife Branch
Ministry of Environment
780 Blanshard Street
Victoria, BC V8V 1X5 CAN
ph (604) 356-0928

Manitoba Conservn. Data Centre
c/o Surveys and Mapping Branch
1007 Century Street
Winnipeg, Manitoba R3H 0W9
CAN
ph (204) 945-2911

Le Centre de Donnees sur le Patrimoine Naturel de Quebec
Ministere de l'Environnement
Direction de la conservation et du patrimoine ecologique
2360 Ch. Ste-Foy, 1er etage
Sainte-Foy, Quebec G1V 4H2 CAN
ph (418) 644-3358

Natural Heritage Info. Center
P.O. Box 7000
Peterborough, Ontario K9J 8M5
CAN
ph (705) 745-6767

Saskatchewan Conservation Data Centre
SK Dept of Natural Resources
3211 Albert Street
Regina, SK S4S 5W6 CAN
ph (306) 787-7196

CANADA DATA NETWORK COOPERATORS:

The Nature Conservancy of Canada
110 Eglinton Ave. W., 4th Floor
Toronto, Ontario M4R 2G5 CAN
ph (416) 932-3202

Canada Rare Plant Project
Botany Division
Canadian Museum of Nature
P.O. Box 3443 - Station D
Ottawa, Ontario K1P 6P4 CAN

The Nature Trust of British Columbia
100 Park Royal South
West Vancouver, BC V7T 1A2
CAN
ph (604) 925-1128

Native Plant Nursery List

Arkansas

Holland Wildflower Farm
290 O'Neal Lane
Elkins, AR 72727
(501) 643-2622

Ridgecrest Nursery
U.S. Hwy. 64 East
Rt. 3 box 241
Wynne, AR 72396
(501) 238-3763

Connecticut:

Comstock, Ferre, & Co.
263 Main Street, jP.O. Box 125
Wetherfield, CT 06109

Illinois:

Country Road Greenhouses, Inc.
19561 East Twombly
Rochelle, IL 61068
(815) 384-3311

Bluestem Prairie Nursery
R.R. 2, Box 106-A
Hillsboro, IL 62049
(217) 532-6344

Peter Schramm
Prairie Restorations
766 Bateman Street
Galesburg, IL 61401
(309) 343-2608

Genesis Nursery, Inc.
R.R. 1, Box 32
Walnut, IL 61376
(815) 379-9060

LaFayette Home Nursery
Lafayette, IL 61449
(309) 995-3311

Midwest Wildflowers
Box 64
Rockton, IL 61072

Genesis Nursery
23200 Hurd Road
Tampico, IL 61238
(815) 438-2220

H.E. Nursery
1200 North Old RT 66
Litchfield, Il 62056
(217) 324-6191

Midwest Wildflowers
P.O. Box 64
Rockton, Il 61072
(815) 624-7040

Country Road Greenhouses, Inc
Rt. 1 Box 62
Malta, IL 60150
(815) 825-2305

Indiana:

J.F. New & Associates
P.O. Box 243
Walkerton, IN 46574
(219) 586-3400

Spence Nursery, Inc.
P.O. Box 546
Muncie, IN 43708
(317) 286-7154

Kentucky:

Shooting Star Nursery
444 Bates Road
Frankfort, KY 40601
(502) 223-1679

Maine:

Daystar
Route 2, Box 250
Litchfield, ME 04350

Maryland:

Kollar Environmental Services
5200 West Heaps Road
Pylesville, MD 21132
(410) 836-0500
Stanley A. Kollar, Jr.

Atlantic Star Nursery
620 Pyle Road
Forest Hill, MD 21237
(410) 838-7950
Sam Jones

Lower Marlboro Nursery
P.O. Box 1013
Dunkirk, MD 20754
(301) 855-7654
Mary Stuart Sierra

Conebrook Nursery
P.O. Box 177
2737 Grier Nursery Road
Forest Hill, MD 21050
(410) 838-4747
James Smith

Bluemont Nursery
2103 Bluemont Road
Monkton, MD 21111
(410) 329-6226

Native Seeds, Inc.
14590 Triadelphia Mill Road
Dayton, MD 21036
(310) 596-9818

Babikow Greenhouses
7838 Babikow Road
Baltimore, MD 21237
(410) 391-4200
Amy Lyman

Wildlife Landscapes
Baltimore, MD
(410) 256-1777

Environmental Concerns, Inc.
P.O. Box P, Chew Ave.
St. Michael's, MD 21663
(410) 848-4789/5806
Joe Barley

Richard Falcone
Waldorf, MD
(310) 870-8038

Weinstock-Bluemel Inc.
2740 Greene Lane
Baldwin, MD 21013
(310) 557-7229

Heartwood Nursery
2121 Blue Mount Road
Monkton, MD 21111
(410) 343-0390
Bob & Sue Dieter

Maryland Cont:

Wildflower
2292 Dunster Lane
Rockville, MD 20854
(310) 762-7750
Jan Midgley

Massachusetts:

Garden in the Woods
Hemenway Road
Framington, MA 01701
(617) 877-6574

Evergreen Tree & Landscape
Larry Hindle
351 Oakhill Avenue
Seekonk, MA 02771

Weston Nurseries, Inc.
P.O. Box 186, Route 135
Hopkinton, MA 01748
(617) 435-3414

New England Wild Flower Society
Garden in the Woods
180 Hemenway Road
Framingham, MA 01701-2699

Quansett Nurseries
Fred Dabney, Claire Ackroyd
794 Horseneck Road
South Dartmouth, MA 02748
(508) 636-6931

Sylvan Nurseries
Mary Hallene
1028 Horseneck Road
Westport, MA 02790

Underwood Shade Nursery
Russell Bragg
P.O. Box 1386
North Attleboro, MA 02763
(508) 222-2164

Weston Nurseries, Inc,
Tom Strangfield
East Main Street (Rt. 135)
P.O. Box 186
Hopkinton, MA 01748
To order: 1-800-322-2002

Minnesota

Feder's Prairie Seed Co.
Route 1 Box 41
Blue Earth, MN 56013

Ferndale Garden Center and Nursery
Askov, MN 55704

Kaste Inc.
RR #2, Box 153
Fertile, MN 56540

Landscape Alternatives, Inc.
1465 North Pascal Street
St. Paul, MN 55108

Mark E. Gullickson
RR #2, Box 150A
Fertile, MN 56540

Minnesota DNR Tree Sales
Forestry Box 95
Willow River, MN 55795

Mohn Seed Co.
RR#1, Box 152
Cottonwood, MN 56229

Morning Sky Greenery
RR #1, Box 365
Morris, MN 56267

Oscar Carlson
Box 157
Lake Bronson, MN 56734

Outback Nursery
15280 110th St. S.
Hastings, MN 55033

Ox Cart Seed Co.
RR #3, Box 226
Hawley, MN 56549

Prairie Moon Nursery
Route 3, Box 163
Winona, MN 55987

Prairie Nursery
PO Box 306
Westfield, WI 53964

Prairie Restorations, Inc.
PO Box 327
Princeton, MN 55371

Schumacher's Berry Farm and Wholesale Nursery Grower
RR 2 Box 10
Heron Lake, MN 56137

Shooting Star Native Seed
RR #2, Box 191
Spring Grove, MN 55974

Wildlife Habitat
RR #3, Box 178
Owatonna, MN 55060

Orchid Gardens
2232-139th Ave., NE
Andover, MN 55304

Missouri:

Elixer Farm Botanicals
Elixer Farm
Brixey, MO 65618
(417) 261-2393

Longview Gardens
11801 E. Bannister Road
Kansas City, MO 64138
(816) 765-5664

Rock Post Wildflowers
Ann Wakeman
5798 Windy Meadows Lane
Fulton, MO 65251
(573) 642-6927

Hamilton Seeds and Wildflowers
Rex and Amy Hamilton
16786 Brown Rd.
Elk Creek, MO 65464
(417) 967-2190

Manglesdorf & Brothers, Inc.
1415 North 13th ST.
St Louis, MO 63106-4424
(314) 421-1415

Sharp Bros. Seed Co. Of Missouri
396 SW Davis St - LaDue
Clinton, MO 64735
(816) 885-7551

J & J Seed Company
Route 3 Box 134
Gallatin, MO 64640
(816) 663-3165

Minnesota Cont:

Missouri Wildflowers Nursery
Merv and Ginny Wallace
9814 Pleasant Hill Road
Jefferson City, MO 65109
(573) 496-3492

Nebraska

Flatland Impressions
1307 L St.
Aurora, NE 68818
(402) 694-5535

Paul E. Allen Farm Supply
Route 2, Box 8
Bristow, NE 68710
(402) 583-9924

Stock Seed Farms, Inc
Route 1, Box 112
Murdock, NE 68407
(402) 867-3771

New Jersey:

Pineland Nursery
323 Island Road
Columbus, NJ 08022
(609) 291-9486

Thompson & Morgan
P.O. Box 1308
Jackson, NJ 08527
1-800-367-7333

Wild Earth Nursery
49 Mead Ave.
Freehold, NJ 07728

Hess Nurseries, Inc.
Box 326
Cedarville, NJ 08311
(609) 447-4213

New York:

Botanic Garden Seed Co.
9 Wyckoff Street
Brooklyn, NY 11237
(718) 624-8839

Harris Moran Seed Co.
3670 Buffalo Rd
Rochester, NY 14624
(716) 594-9411

Wildginger Woodlands
P.O. Box 1091
Webster, Ny 14580
(716) 872-4033

North Carolina:

Laurel Springs Nursery
401 Regal Street
Hendersonville, NC 28739

Holbrook Farm & Nursery
Route 2, Box 223B
Fletcher, NC 28732
(704) 891-7790

We-Du Nurseries
Route 5, Box 724
Marion, NC 28752
(704) 738-8300

Niche Gardens
1111 Dawson Rd
Dept. VN
Chapel Hill, NC 27516
(919) 967-0078

Lamtree Farm
Rt. 1 Box 162
Warrensville, NC 28693

Passiflora
P.O. Box 393
Germanton, NC 27019
(919) 591 5816

Nature's Garden
372 Welch Rd.
Bryson Ctiy, NC 28713
(704) 488-6010

Oklahoma:

Earth Wildflowers
2520 Main
Woodward, OK 73801
(405) 254-2926

Johnston Seed Company
P.O. Box 1392
Enid, OK 73702
(405) 233-5800

Pennsylvania:

Octoraro Wetland Nursery
P.O. Box 24
Oxford, PA 19363
Oxford, PA (610)932-3762
Elkton, MD (410)392-8175
Jim McKenzie

Temple University
Native Plant Propagation Center
580 Meetinghouse Road
Ambler, PA 19002
(215) 283-1330

Native and Aquatic Nursery
834 Church Road
Harleysville, PA 19438
(610) 584-6302
Sandy Wilson

Applachian Nursery
RR1 Box 12 Island road
Waynesboro, PA 17268

Conard-Pyle Company
372 Rosehill Road
West Grove, PA 19390

North Creek Nurseries
RR 2, Box 33
Ladenburg, PA 19350
(215) 283-1330
(215) 255-0100
Dale Hendricks

Sylva Native Nursery & Seed
Rd. #2, Box 1033
New Freedom, PA 17349
(717) 227-0486
Mike Hollins

Natural Landscapes
354 N. Jennersville Rd.
West Grove, PA 19390
(610) 869-3788

Bowman's Hill
Washington Crossing Park
P.O. Box 183
Washington Crossing, PA 18977

Doyle Farm Nursery
158 Norris Raod
Round Hill, VA 22141
(703) 338-7238

Pennsylvania Cont:

Appalachian Wildflower Nursery
Route 1, Box 275A
Reedsville, PA 17084
(717) 667-6998

W. Atlee Burpee Co.
300 Park Ave
Warminster, PA 18974
(215) 674-4900

Beachley-Hardy Seed Co.
P.O. Box 336
Camp Hill, PA 17011
(717) 737-4529

Painted Meadows Seeds
P.O. Box 1865
Kingston, PA 18704
(717) 283-2911

Rhode Island:

Dave-Chris Farm & Nursery
Lucille Dickinson
3029 South County Trail
West Kingston, RI 02892-1087
(401) 783-0224

Friendship Gardens
Carolyn Curtis
2255 Commodore O.H. Perry Highway
Wakefield, RI 02879
(401) 783-1646

Plane View Nursery
Mike Medeiros
770 Wapping Road
Portsmouth, RI 02871
(401) 849-2464

Pond Meadow Nursery
Brian O'Connor
28 Pond Meadow Road
Charlestown, RI 02813
(401) 364-3028

Tennessee:

Native Gardens
Rt. 1 Box 4916, Fisher Lane
Greenback, TN 37742
(615) 856-3350

Sunlight Gardens
Route 3, Box 286 B
Loudon, TN 37774
(615) 986-6071

Natural Gardens
113 Jasper Lane
Oak Ridge, TN 37830

Virginia:

Virginia Natives
Wildside Farms
Box 18
Hume, Va 22639
(703) 364-1665
Mary Painter

Waterways Nursery
13015 Milltown Rd
Lovettsville, Va 22080
(540) 822-5994

Boutique
Rt. 1, Box 183
Standardsville, Va 22973
(804) 985-3060

Virginia Wilde Farms
Rt. 2, Box 1512
Hanover, VA 23069
(804) 643-0021

Belle Aire Garden Shoppe, Inc
4119 Brandon Ave.
Roanoke, Va 24018
(703) 774-7444

Blue Ridge Nursery & Garden
3212 Brambleton Ave.
Roanoke, Va 24018
(703) 989-5336

Acid-Wetlands Flora
1705 N. Quebec St.
Arlington, VA 22207
(703) 524-3181

Holley's Hobbies
Rt. Box 270A
Warrentown, VA 22186
(703) 347-7663

Round Hill Garden
Box 196
Round Hill, VA 22141
(703)338-7238

Rod Simmons
Falls Church, VA
(703) 256-7671

Mid-Atlantic Wildflowers
Star Route, Box 226
Gloucester Point, VA 23062
(804) 642-4602

Swell Nursery
505 Baldwin Rd
Richmond, VA 23229
(804) 288-7873

Antique Orchid Herbary
Rt. 6, Box 734
Abingdon, VA 24210
(703) 628 1463

Bell's Farm Nursery
4038 Harborwood Rd.
Salem, VA 24153
(703) 389-3082

Townside Gardens
3514 Franklin Road
Roanoke, VA 24014
(703) 344-7025

Everwood Nursery
Round Hill, VA 22141
(703) 338-4227

Keatocin Perennials
Rt. 3, Box 58
Leesburg, VA 22075
(703) 777-1787

Washington, D.C.:

Lou Aronica
Washington, D.C.
(202 722-1390

West Virginia:

Sunshine Farm & Garden
Route 5 EN
Renick, WV 24966
(304) 497-3163

I. PLANT MATERIALS SPECIALISTS

ARIZONA/NEVADA
James Briggs
3003 N. Central Ave., Suite 800
Phoenix, AZ 85012-2954
(602) 280-8824

CALIFORNIA
Robert Slayback
2121-C 2nd St.
Davis, CA 95616-5475
(916) 757-8257

FLORIDA
Samuel Sanders
Federal Bldg., 401 SE 1st Ave. #248
Gainesville, FL 32601-6805
(904) 376-7414

GEORGIA/ALABAMA
Edward D. Surrency
355 E. Hancock Ave., Box 13, Federal Bldg.
Athens, GA 30601
(706) 546-2114

HAWAII
Robert J. Joy
Box 236
Hoolehua, HI 96729
(808) 567-6885

IDAHO/UTAH
Dan Ogle
3244 Elder St. #124
Boise, ID 83705-4711
(208) 334-1336

LOUISIANA
Mike Materne
P.O. Box 16030, University Station
Baton Rouge, LA 70893
(504) 389-0335

MISSISSIPPI/ARKANSAS
Joel L. Douglas
Route 3, Box 215A
Coffeeville, MS 38922
(601) 675-2588

MISSOURI/IOWA/ILLINOIS
John L. Reid
Parkade Center, Suite 250
601 Business Loop 70 West
Columbia, MO 65203
(314) 876-0908

MONTANA/WYOMING
Larry K. Holzworth
Federal Bldg., 10 E. Babcock St.
Bozeman, MT 59715
(406) 587-6838

NEW JERSEY/MARYLAND/DELAWARE/RHODE ISLAND/MASSACHUSETTS/CONNECTICUT
Christopher P. Miller
1370 Hamilton St.
Somerset, NJ 08873
(908) 246-4110

NEW YORK/VERMONT/NEW HAMPSHIRE/MAINE
John A. Dickerson
P.O. Box 7248, Federal Bldg., room 771
100 S. Clinton St.
Syracuse, NY 13761-7248
(315) 423-5520

MICHIGAN/WISCONSIN/INDIANA
David Burgdorf
U.S. Soil Conservation District
1404 S. Harrison Road
E. Lansing, MI 48823-5202
(517) 337-6701 ext. 1211

NORTH DAKOTA/SOUTH DAKOTA/MINNESOTA
Russell J. Haas
Federal Bldg., Room234
P.O. Box 1458, Rosser Ave. & 3rd St.
Bismarck, ND 58502
(701) 250-4425

PENNSYLVANIA/OHIO
Robert J. Glennon
1 Credit Union Place, Suite 340
Harrisburg, PA 17110-2993
(717) 782-4403

TEXAS
James S. Alderson
W.R. Poage Federal Bldg.
101 S. Main Street
Temple, TX 76501
(817) 774-1291

WASHINGTON/OREGON
Scott M. Lambert
Rock Point Tower II, Suite 450
W. 316 Boone Ave.
Spokane, WA 99201
(509) 353-2335

W. VIRGINIA/KENTUCKY
John Vandevender
USDA SCS Agriculture Research Service
P.O. Bx 867
Beckley, WV 25802-0867
(304) 256-2879

__States without listed PMS__:

COLORADO
655 Parfer St. Room E200C
Lakewood, CO 80215-5517
(305) 236-2913

NEW MEXICO
517 Gold Ave. SW Room 3301
Albuquerque, NM 87102-3137
(505) 766-3277

N. CAROLINA/S. CAROLINA/VIRGINIA
4405 Bland Rd. Suite 205
Raleigh, NC 27609
(919) 790-2896

KANSAS/OKLAHOMA/NEBRASKA
760 S. Broadway
Salina, KS 67401
(913) 823-4541

II. USEFUL CONTACTS

__American Association of Botanical Gardens and Arboreta__
786 Church Red. Wayne, PA 19087
(610) 688-1120
Executive Director: Susan Lathrop

* The AABGA has member gardens and arboreta throughout the country, with 25% being university campuses. They have a University Gardens Committee and an extensive resource center (lending library), as well as a "University Gardens" notebook with articles and information about starting an arboretum on campus. They also have information about natural lands and native species. They may be able to put you in touch with Universities in your area which have already created an arboretum and could assist with your efforts. We recommend you contact the AABGA as they are well-equipped to help you start your "university garden!"

__Botanical Society of America__
1735 Neil Ave. Columbus, OH
(614) 292-3519
Business Office: Kim Hiser

* The Botanical Society of America is a national society of plant scientists with over 2700 members, mostly from academic institutions. They exist to promote research and teaching of plant biology, to facilitate cooperation among plant biologists, to encourage projects of botanical interest, and to disseminate knowledge of plants, algae and fungi to all groups of society for solving the practical problems of humanity. They can put you in contact with a member nearest to your school who may be able to help with their expertise.

__The Forest Service__
P.O. Box 96090, Washington, D.C. 20090-6090
(202) 205-0957

* Part of the U.S. Department of Agriculture, they conduct research in the entire field of forestry and wildland management. They may be able to advise you on trees and other plants species that are native to your area.

National Wildflower Research Center
2600 FM 973 Austin, TX 78725
(512) 929-3600

• The National Wildflower Research Center is a non-profit organization promoting the use of native plants in landscaping as a means to preserve and reestablish native flora and create a desirable environment for future generations. Botanists at the Center conduct original and collaborative research on propagation, establishment, and management of native plants. The Center's Clearinghouse provides over 200 fact sheets to the public, and introductory packets ofinformation can be purchased by sending $4 to the Clearinghouse at the above address. A $25 membership will get you this information free, along with a bimonthly newsletter, a scientific journal, a discount on products from the Center's gift catalog, and advance notice of special events and ecotours. Education programs, materials, and speakers are available for schools, garden clubs, and professional associations.

The Nature Conservancy
1815 North Lynn St. Arlington, VA 22209
(703) 841-5300

• National nonprofit organization dedicated to preserving biological diversity by protecting natural lands. They cooperate with educational institutions, public and private conservation agencies. They have "natural heritage programs" to identify ecologically significant natural areas and document indigenous and extirpated species. You can call their national office to get a number for a local Nature Conservancy office near you.

New England Wildflower Society, Inc.
Garden in the Woods, 180 Hemenway Rd., Framingham, MA 01701-2699
(617) 237-4924

Nonprofit organization established to promote the conservation of temperate North American flora. They are also a clearinghouse for native plant projects in the New England region. They own 438 acres of sanctuaries protecting rare native plants; "Garden in the Woods" is the largest landscaped botanical collection of native plants in the Northeast.

III. SOURCES OF NATIVE PLANT MATERIALS

•[This list was adapted with permission from Taylor's Guide to Natural Gardening, Houghton Mifflin Company, 1993]

Key:
MO: mail order
Nu: on-site sale
Gdn: display garden
[S]: seeds
[P]: plants
appt: some restriction, call to make sure

• For a copy of the Annual Directory of Native Plant Sources, write to: Hortus Northwest PO Box 955, Canby, OR 97013 ($9)

Alabama

Magnolia Nurser& Display Garden[P]
12615 Roberts Road
Chunchula, AL 36521
(205) 675-4696
Southeastern natives
Catalog: $2
MO, Nu (appt), Gdn (appt)

Arizona

Desert Enterprises[S]
P.O. Box 23
Morristown, AZ 85342
(602) 388-2448
Cacti, desert shrubs, grasses, trees, wildflowers
Catalog: free
MO

Hubbs Brothers Seed Company [S]
40 N. 56th St.
Phoenix, AZ 85034
(602) 267-8132
Plants of Sonoran & Mohave deserts
Catalog: free
MO, retail store

California

Clyde Robin Seed Co. [S]
P.O. Box 2366
Castro Valley, CA 94546
(415) 785-0425

Shrubs, trees, wildflowers,
Catalog: free
MO

Greenlee Nursery [P, S]
301 E. Franklin Ave.
Pmoona, CA 91766
(714) 629-9045
Grasses
Catalog: $5 (free price list)
MO, Nu (appt)

Larner Seeds [P, S]
P.O. Box 407
235 Grove
Bolinas, CA 94924
(415) 868-9407
Grasses, shrubs, trees, vines, wildflowers
Catalog: $2
Mo, Nu (appt), Gdn (appt)

Las Pilitas Nursery [P, S]
Stara Route, Bnox 23X
Las Pilitas Rd.
Santa Margarita, CA 93453
(805) 438-5992
Shrubs, trees, wildflowers
Catalog: $4 (free price list)
MO, Nu (appt), Gdn (appt)

The Living Desert [P]
47900 Portola Ave.
Palm Desert, CA 92260
(619) 346-5694
Grasses, shrubs, trees, wildflowers
Catalog: monthly price list
Nu, Gdn

Mockingbird Nursery [P]
1670 Jackson St.
Riverside, CA 92504
(714) 780-3571
Shrubs, trees
Catalog: free

Moon Mountain Wildflowers [S]
P.O. Box 34
864 Nappa Ave.
Morro Bay, CA 93442
Wildflowers
Catalog: $2
MO

The Theodore Payne Foundation [P, S]
10459 Tuxford St.
Sun Valley, CA 91352
(818) 768-1802
Grasses, shrubs, trees, wildflowers
Catalog: $2
MO (seed only), Nu, Gdn

Wildwood Nursery [P, S]
P.O. Box 1334
3975 Emerald Ave. [in La Verne]
Claremont, CA 91711
(714) 593-4093 or 621-2112
Grasses, shrubs, trees, wildflowers
Catalog: $1
MO, Nu, Gdn

Yerba Buena Nursery [P, S]
19500 Skyline Blvd.
Woodside, CA 94062
(415) 851-1668
Ferns, grasses, shrubs, trees, wildflowers
Catalog: $1
Nu

Colorado

Nells Lunceford [P, S]
Box 2130
740 Blue River Pkwy.
Silverthorne, CO 80498
(303) 468-0340
High-altitude grasses, shrubs, trees, wildflowers
Catalog: free plant list
MO, Nu, Gdn

Delaware

Winterthur Museum and Gardens [P]
Kennet Pike, Rte. 52
Winterthur, DE 19735
(302) 888-4600
Shrubs, trees, wildflowers
Catalog: $1
MO, Nu

Florida

Blake's Nursery [P]
Rte. 2, Box 971
Madison, FL 32340
(904) 971-5003
Shrubs, trees
Catalog: free price list w/SASE
MO, Nu (appt), Gdn (appt)

Native Nurseries [P, S]
1661 Centerville Rd.
Tallahassee, FL 32308
(904) 386-8882
Shrubs, trees, wildflowers
Nu, Gdn

Georgia

Goodness Grows [P]
P.O. Box 311
Highway 77 North
Lexington, GA 30648

(404) 743-5055
Grasses, wildflowers
Nu, Gdn

Piccadilly Farm
1971 Whippoorwill Rd.
Bishop, GA 30621
(404) 769-6516
Shrubs, trees, wildflowers
Catalog: $1
Nu (appt), Gdn (appt)

Transplant Nursery [P]
Rte. 2, Parkertown Rd.
Lavonia, GA 30553
(404) 356-1658
Shrubs
Catalog: $1
MO, Nu, Gdn

Idaho

High Altitude Gardens [S]
P.O. Box 4238
500 Bell Dr. 7
Ketchum, ID 83340
(208) 726-3221
Grasses, wildflowers
Catalog: $2
MO, Nu (appt), Gdn (appt)

Native Seed Foundation [S]
Star Route, Road 73
Moyie Springs, ID 83845
Trees, shrubs of Pacific NW
Catalog: price list
MO (wholesale only)

Northplan/Mountain Seed [S]
P.O. Box 9107
Moscow, ID 83843-1607
(208) 882-8040
Shrubs, trees, wildflowers
Catalog: native seed list: long SASE
MO

Iowa

Ion Exchange [P, S]
Rte. 1, Box 48C
Harpers Ferry, IA 52146
(319) 535-7231
Grasses, wildflowers
Catalog: free
MO

Smith Nursery Co. [P, S]
P.O. Box 515
Charles City, IA 50616
(515) 228-3239
Shrubs, trees
Catalog: free price list
MO

Illinois

Bluestem Prairie Nursery [P, S]
Route 2, Box 92
Hillsboro, IL 62049
(217) 532-6344
Wildflowers of Illinois prairie
Catalog: free
MO

Lafayette Home Nursery [P, S]
R.R. 1, Box 1A
Layfayette, IL 61449
(309) 995-3311
Grasses, shrubs, trees, wildflowers
Catalog: free
MO, Nu (appt), Gdn (appt)

The Propagator's Private Stock [P]
8805 Kemman Rd.
Hebron, IL 60034
No Phone
Shrubs, small trees, wildflowers
Catalog: free
MO

Kansas

Sharp Bros. Seed Co. [S]
P.O. Box 140
Healy, KS 67850
(316) 398-2231
Grasses, wildflowers
Catalog: $5
MO

Louisiana

Gulf Coast Plantsmen [P]
15680 Perkins Rd.
Baton Rouge, LA 70810
(504) 751-0395
Shrubs, trees, wildflowers for lower South
Catalog: none
Nu (appt)

Louisiana Nursery [P]
Rte. 7, Box 43
Opelousas, LA 70570
(318) 948-3696
Shrubs, trees, wildflowers
Catalog: $5
MO, Nu (appt), Gdn (appt)

Maryland

Environmental Concern [P, S]
P.O. Box P
210 West Chew Ave.
St. Michaels, MD 21663
(301) 745-9620
Wetland plants: grasses, shrubs, trees, wildflowers
Catalog: free
MO, Nu (appt)

Kurt Bluemel [P, S]
2740 Greene La.
Baldwin, MD 21013
(301) 557-7229
Grasses, wildflowers
Catalog: $2
MO

Michigan

The Michigan Wildflower Farm[P, S]
11770 Cutler Rd.
Portland, MI 48875-9452
(517) 647-6010
Native MI wildflowers (sunny prairie species)
Native MI grasses will be available in late 1997
Catalog: free
MO, Nu (appt)

Minnesota

Booming Native Plants [P, S]
2323 County Rd. 6
Barnum, MN 55707
(218) 389-3220
Wildflowers, native grasses
Catalog: flyer
MO, Nu (appt)

Landscape Alternatives [P, S]
1465 Pascal St.
St. Paul, MN 55108
(612) 488-3142
Grasses, wildflowers of MN and prairie
Catalog: $2
MO, Nu (appt), Gdn (appt)

Prairie Moon Nursery [P, S]
Rte. 3, Box 163
Winona, MN 55987
(507) 452-1362
Grasses, wildflowers of prairie
Catalog: $2
MO, Nu (appt), Gdn (appt)

Prairie Restorations, Inc. [P, S]
P.O. Box 327
Princeton, MN 55371
(612) 389-4342
Grasses, wildflowers (dryland, woodland,& wetland)
Catalog: free
MO, Nu, Gdn (appt)

Missouri

Missouri Wildflowers Nursery [P, S]
9814 Pleasant Hill Rd.
Jefferson City, MO 65109
(314) 496-3492
Grasses, wildflowers of MO
Catalog: $1
MO, Nu (appt)

Montana

Valley Nursery [P]
P.O. Box 4845
21801 N. Montana Ave.
Helena, MT 59604
(406) 442-8460
Hardy shrubs, trees
Catalog: list with SASE
MO, Nu, Gdn

Nebraska

Bluebird Nursery [P, S]
P.O. Box 460
519 Bryant St.
Clarkson, NE 68629
(402) 892-3457
Grasses, shrubs, wildflowers
Catalog: free
MO, Nu (appt), Gdn (appt)

The Fragrant Path
P.O. Box 328
Fort Calhoun, NE 68023
No Phone
Catalog: $1
MO

New Jersey

Lofts Seed [S]
Chimney Rock Rd.
Bound Brook, NJ 08805
(908) 560-1590
Grasses, wildflowers
Catalog: free
MO, Nu (appt)

New Mexico

Aqua Fria Nusery [P]
1409 Agua Fria St.
Santa Fe, NM 87501
(505) 983-4831
Wildflowers
Nu

Bernardo Beach Native Plant Farm [P, S]
520 Montano Rd. N.W.
Albuquerque, NM 87107
(505) 345-6248
Shrubs, trees, wildflowers
Nu

Desert Moon Nursery [P]
P.O. Box 600
Veguita, NM 87062
Natives, drought-tolerant plants
Catalog: $1
MO, Nu (appt), Gdn (appt)

Plants of the Southwest [P, S]
930 Baca St.
Santa Fe, NM 87501
(505) 983-1548
Grasses, shrubs, trees, wildflowers
Catalog: $1.50
MO, Nu

North Carolina

Holbrook Farm & Nursery [P]
P.O. Box 368
115 Lance Rd.
Fletcher, NC 28732
(704) 891-7790
Shrubs, trees, wildflowers
Catalog: $2
MO, Nu, Gdn

Niche Gardens [P]
1111 Dawson Rd.
Chapel Hill, NC 27516
(919) 967-0078
Wildflowers of Southeast
Catalog: $3
MO, Nu (appt), Gdn (appt)

Oregon

Forest Farm [P]
990 Tetherow Rd.
Williams, OR 97544-9599
(503) 846-6963
Shrubs, trees, wildflowers
Catalog: $3
MO, Nu (appt)

Siskiyu Rare Plant Nursery [P]
2825 Cummings Rd.
Medford, OR 97501
(503) 772-6846
Wildflowers, dwarf shrubs and trees for rock gardens
Catalog: $2
MO, Nu (appt), Gdn (appt)

Pennsylvania

Appalachian Wildflower Nursery
Route 1 Box 275A
Reedsville, PA 17084
No Phone
Catalog: $2
MO

Jacob's Ladder Natural Gardens [P]
1375 Consho. State Road
P.O. Box 145
Gladwyne, PA 19035
(215) 525-6773
Shrubs, trees, wildflowers
Catalog: free
Nu

Musser Forests [P]
P.O. Box 340
Rte. 119 North
Indiana, PA 15701
(412) 465-5686
Shrubs, trees
Catalog: free
MO, Nu

South Carolina

Woodlanders, Inc. [P]
1128 Colleton Ave.
Aiken, SC 29801
(803) 648-7522
Shrubs, trees, wildflowers
Catalog: $1
MO, Nu (appt), Gdn (appt)

Tennessee

Native Gardens [P, S]
5737 Fisher La.
Greenback, TN 37742
(615) 856-3350
Shrubs, trees, wildflowers
Catalog: $2
MO, Nu (appt), Gdn (appt)

Sunlight Gardens [P]
Rte. 1 Box 600-A
Andersonville, TN 37705
(615) 494-8237
Wildflowers
Catalog: $2
MO, Nu, Gdn

Texas

Antique Rose Emporium [P]
Rte. 5 Box 143
Brenham, TX 77833
(409) 836-9051

Shrubs, trees, wildflowers
Catalog: $5
MO, Nu, Gdn

The Lowery Nursery [P]
2323 Sleepy Hollow Rd.
Conroe, TX 77385
(713) 367-4076
Grasses, shrubs, trees, wildflowers
Catalog: none
Nu (appt)

Native American Seed [S]
3400 Long Prairie Road
Flower Mound, TX 75028
No phone
Catalog: $1
MO

Turner Seed Co. [S]
Rte. 1 Box 292
Breckenridge, TX 76424
(817) 559-2065
Grasses, wildflowers (by the lb.)
Catalog: free: long SASE
MO

Wildseed, Inc. [S]
P.O. Box 308
Eagle Lake, TX 77434
(409) 234-7353 or (800) 848-0078
Grasses, wildflowers
Catalog: free
MO, Nu (appt), Gdn (appt)

Yucca Do Nursery [P]
P.O. Box 655
Waller, TX 77484
(409) 826-6363
Native Texas plants
Catalog: $3
MO

Vermont

Vermont Wildflower Farm [S]
U.S. Rte. 7
Charlotte, VT 05445
(802) 425-3500
Wildflowers
Catalog: free
MO, Nu, Gdn

Virginia

Andre Viette Farm & Nursery [P]
Rte. 1 Box 16
Fisherville, VA 22939
(703) 943-2315
Wildflowers
Catalog: $2
MO, Nu, Gdn

Washington

Frosty Hollow Ecological Restoration [S]
Box 53
Langley, WA 98260
(360) 579-6456
Native grasses, shrubs, trees and wildflowers of Pacific NW
Catalog: annual seed list (with self addressed, stamped envelope)
MO

Plants of the Wild [P, S]
P.O. Box 866
Willard Field
Tekoa, WA 99033
(509) 284-2848
Grasses, shrubs, trees, wildflowers
Catalog: $1
MO, Nu (appt), Gdn (appt)

Wisconsin

Country Wetlands Nursery & Consulting, Ltd. [P, S]
South 75, West 20755 Field Dr.
Muskego, WI 53150
(414) 679-1268
Grasses, shrubs, trees, wildflowers
Catalog: $2
MO, Nu (appt), Gdn (appt)

Little Valley Farm [P, S]
R.R. 3 Box 544
Spring Green, WI 53588
(608) 935-3324
Shrubs, vines, wildflowers of midwest
Catalog: free with first class stamp
MO, Nu (appt)

Prairie Ridge Nursery [P, S]
9738 Overland Rd.
Mt. Horeb, WI 53572-2832
(608) 437-5245
Wildflowers and grasses for prairies, woodlands, and wetlands
Catalog: $3 ($3 coupon included)
MO, Nu (appt), Gdn (appt)

Prairie Nursery [P, S]
P.O. Box 306
3291 Dyke Ave.
Westfield, WI 53964
(608) 296-3679
Grasses, wildflowers
Catalog: $3
MO, Gdn (appt)

IV. NATIVE PLANT SOCIETIES & ALTERNATE CONTACTS

The Native Plant Societies and alternate contacts listed here are comprised of amateurs and professionals with a common interest in the preservation of native plants and habitats in their region. Ask for a local chapter contact in or near your city. Please note: the contact names, addresses, and numbers are subject to change so you may have to ask for the most current one.

Alabama Wildflower Society
George Wood
Route 2, Box 115
Northport, AL 35476

Alaska Native Plant Society
P.O. Box 141613
Anchorage, AK 99514

Arizona Native Plant Society
P.O. Box 41206 Sun Station
Tuscon, AZ 85717

Arkansas Native Plant Society
Don Peach
Route 1, Box 282
Mena, AR 71953

California Botanical Society
Department of Botany
University of California
Berkley, CA 94720

The California Native Plant Society
1722 J St., Suite 17
Sacramento, CA 95814
President: George Clark
(916) 447-2677

Colorado Native Plant Society
Box 200
Fort Collins, CO 80522

Connecticut Botanical Society
Donald Swan
1 Livermore Trail
Killingworth, CT 06417

Florida Native Plant Society
P.O. Box 680008
Orlando, FL 32868
(407) 299-1472

Georgia Botanical Society
Dr. Frank McCamey
1676 Andover Ct.
Doraville, GA 30360

Hawaiian Botanical Society
c/o Botany Dept.
University of Hawaii
3190 Maile Way
Honolulu, HI 96822
(808) 956-8072/3931

Idaho Native Plant Society
P.O. Box 9451
Boise, ID 83707
President: Susan Bernatas

Illinois Native Plant Society
Forest Glen Preserve
R.R. 1, Box 495A
Westville, IL 61883
(217) 662-2142

(Indiana) **A.N.V.I.L.**
871 Shawnee Ave.
Lafayette, IN 47905

Kansas Wildflower Society
Mulvane Art Center
Washburn University
17th & Jewell St.
Topeka, KS 66621

Louisiana Native Plant Society
Richard Johnson
216 Caroline Dorman Rd.
Saline, LA 71070
(318) 576-3379

(Maine) **Josselyn Botanical Society**
Charles D. Richards
Deering Hall, University of Maine
Orono, ME 04469

Maryland Native Plant Society, Inc.
P.O. Box 4877
Silver Spring, MD 20914
Membership Chair: Lou Aronica
(202) 722-1390

Michigan Botanical Club
Matthaei Botanical Gardens
1800 Dixboro Rd.
Ann Arbor, MI 48105

Minnesota Native Plant Society
220 Biological Sciences Center
1445 Gortner Ave., Univ. of Minnesota
St. Paul, MN 55108
President: Don Knutson (612) 721-6123

Mississippi Native Plant Society
P.O. Box 2151
Starkville, MS 39759
President: Victor Rudis (601) 324-0430

Missouri Native Plant Society
P.O. Box 20073
St. Louis, MO 63144-0073
(316) 235-4740
President: Stephen Timme

Missouri Prairie Foundation
P.O. Box 200
Columbia, MO 65205
President: Randy Washburn
(314) 636-2765

Northern Nevada Native Plant Society
Box 8965
Reno, NV 89507

New Jersey Native Plant Society
Frelinghuysen Arboretum
Box 1295R
Morristown, NJ 07960

Native Plant Society of New Mexico
P.O. Box 5917
Sante Fe, NM 87502

(New York) **Torrey Botanical Club**
New York Botanical Garden
Bronx, NY 10458

North Carolina Wildflower Preservation Society
North Carolina Botanical Garden
UNC-CH Totten Center 457-A
Chapel Hill, NC 27514

Ohio Native Plant Society
Ann Malmquist
6 Louise Drive
Chagrin Falls, OH 44022

Oklahoma Native Plant Society
Dr. John Taylor
Rte. 1, Box 157
Durant, OK 74701

Native Plant Society of Oregon
Frank A. Lang
Dept. of Biology
Southern Oregon State College
Ashland, OR 97520

Pennsylvania Native Plant Society
Commonwealth Bldg.
316 Fourth Ave.
Pittsburgh, PA 15222

Tennessee Native Plant Society
Dept. of Botany
University of Tennessee
Knoxville, TN 37916

Native Plant Society of Texas
P.O. Box 891
Georgetown, TX 78627
(512) 863-9685
President: Kate Hillhouse (409) 327-4741

Utah Native Plant Society
State Arboretum of Utah
University of Utah, Bldg. 436
Salt Lake City, UT 84112

Virginia Native Plant Society
P.O. Box 844
Annandale, VA 22003
President: Nicky Staunton
H:(703) 368-9803
W:(703) 368-3943

Washington Native Plant Society
Department of Botany, AJ-30
Univ. of Washington
Seattle, WA 98195
(206) 543-1976/1942
President: Clay Antieau (206) 784-1138

West Virginia Native Plant Society
Herbarium, Brooks Hall
West Virginia University
Morgantown, WV 26506

Wyoming Native Plant Society
P.O. Box 1471
Cheyenne, WY 82001

ALABAMA

Auburn University Arboretum
Auburn (205) 844-5770
13 acres, native Alabama trees and shrubs are featured.

The Birmingham Botanical Garden
Birmingham (205) 879-1227
67 acres with many displays.

Mobile Botanical Gardens
Mobile (205) 342-0555
Its 64 acres contain native azaleas, camellias, herbs and ferns.

ARIZONA

The Arboretum at Flagstaff
Flagstaff (602) 774-1441
200 acres, featuring demonstration gardens and research on water-efficient plants.

Arizona-Sonora Desert Museum
Tuscon (602) 883-2702 or 883-1380
186 acres, including native plants in natural habitats.

Boyce Thompson Southwestern Arboretum
Superior (602) 689-2811 or 689-2723
35 acres, including arid-land plants

Desert Botanical Garden
Phoenix (602) 941-1217
150 acres of natural desert, with native cacti

CALIFORNIA

Berkeley Botanical Garden
Univ. of California, Berkeley (415) 642-3343
Among the best university botanical gardens in the U.S. with an outstanding collection of California plants.

Lummis Home State Historical Monument
Los Angeles (213) 222-0546
2 acres, low-water, low-maintenance garden.

Rancho Santa Ana Botanic Garden
Claremont (714) 626-3922
85 acres devoted exclusively to California's indigenous plants.

Regional Parks Botanic Garden
Tilden Park (510) 841-8732
10 acres, featuring a display of California plant communities.

Strybing Arboretum and Botanical Gardens
San Francisco (415) 661-1316
This 70-acre facility features California natives and adapted plants.

COLORADO

Chautauqua Park
Boulder (303) 441-3408 (Ranger station)
Part of Boulder Parks and Recreation, this park features mountain habitats and trails.

Denver Botanic Gardens
Denver (303) 575-2547
A 50-acre garden complex with additional acres on Mt. Goliath. Features alpine and other gardens.

Oxley Homestead
Golden (303) 526-9463
Native plants featured in residential landscapes.

CONNECTICUT

Connecticut College Arboretum
Connecticut College
New London (203) 447-1911
The 425-acre arboretum was established to provide students and the public with research in horticulture, conservation, and ecology.

DELAWARE

Mount Cuba Center for the Study of Piedmont Flora
Greenville (302) 239-4244
Contains native plant gardens with wildflowers, trees and shrubs.

Winterthur Museum and Gardens
Winterthur (302) 888-4600
Contains 200 acres of naturalized gardens.

FLORIDA

Fairchild Tropical Garden
Coral Gables (305) 667-1651
One of America's major botanical gardens.

GEORGIA

Atlanta Botanical Garden
Atlanta (404) 876-5858
60-acre garden has fine collections of indigenous plants. Officially certified by National Wildlife Federation's Backyard Wildlife Habitat Program.

Callaway Gardens
Pine Mountain (404) 663-2281
This 2500-acre reserve has many native plants outdoors. Officially certified by National Wildlife Federation's Backyard Wildlife Habitat Program.

University of Georgia Botanical Garden
Athens (404) 542-1244
Important collection of Georgian flora, including rare and endangered species.

HAWAII

Harold L. Lyon Arboretum
University of Hawaii
Honolulu (808) 988-3177
125-acre arboretum contains native and endemic Hawaiian plants and focuses on tropical plant research, ethno-botany, and education.

IDAHO

Charles Huston Shattuck Arboretum
Univ. of Idaho, Moscow (208) 885-6280
The 70-acre arboretum has 200 species of native trees.

ILLINOIS

Elgin Botanical Garden
Trout Park (312) 741-5660
The 18-acre garden has native plants adapted to alkaline conditions.

Lincoln Memorial Garden and Nature Center
Springfield (217) 529-1111
Native Illinois plants recreate 19th-century landscape.

Morton Arboretum
Lisle (708) 968-0074
Features prairie restoration and woody plants.

INDIANA

Hayes Regional Arboretum
Richmond (317) 962-3745
Contains 350 acres, native plants in woodland settings.

IOWA

Des Moines Botanical Center
Des Moines (515) 242-2934

KANSAS

Dyck Arboretum of the Plains
Hesston (316) 327-8127
Hesston College's arboretum featuring native Kansas prairie and adapted plants.

Kansas Landscape Arboretum
Wakefield (913) 263-2540
193 acres containing a large collection of native trees and shrubs.

KENTUCKY

Bernheim Forest Arboretum
Clermont (502) 543-2451
This 14,000-acre forest preserve of indigenous plants has a nature center and museum.

LOUISIANA

University of Southwestern Louisiana Horticulture Center
Lafayette (318) 231-6064
Excellent horticultural library with information on Louisiana flora.

MAINE

Fay Hyland Botanical Plantation
University of Maine, Orono (207) 581-7461
The University of Maine hosts this plantation of native plants.

MASSACHUSSETTS

Arnold Arboretum
Jamaica Plains (617) 524-1718
Part of Harvard University, this major 265-acre arboretum contains over 6000 species (note - its founder introduced over 500 plants to the U.S.)

Botanic Garden of Smith College and Lyman Plant House
Northampton (413) 584-23700 ex 2742
Contains more than 3600 species of plants including extensive greenhouses.

Garden in the Woods (New England Wild Flower Society)
Framingham (508) 877-7630
45 acres, woodland and meadow.

MICHIGAN

Matthaei Botanical Gardens
The University of Michigan
Ann Arbor (313) 764-1168
Much of the 250-acre site is a natural area supporting biological research, and over

700 native plant species are grown in the gardens.

W.J. Beal-Garfield Botanical Gardens
Michigan State University
East Lansing (517) 355-9582
The gardens have over 5500 species for research
and education. It also features a Michigan
endangered and threatened plant exhibit.

MINNESOTA

Eloise Butler Wildflower
and Bird Sanctuary
Minneapolis (612) 374-4305
Emphasis placed on indigenous
plants, including a prairie garden.

Linnaeus Arobretum
St. Peters (507) 933-7324
A 55-acre arboretum recreating Minnesota's
native vegetation types from an 1850 survey.

Minnesota Landscape Arboretum
Chanhassen (612) 443-2460
950 acre arboretum with native prairie and
wildflowers.

MISSISSIPPI

The Crosby Arboretum
Hattiesburg (601) 261-3137
This 64-acre arboretum features native plants
and trees.

Gladney Arboretum
Gloster (504) 225-4216
Excellent 327-acre arboretum with a collection of rare
native plants.

MISSOURI

Missouri Botanical Gardens
St. Louis (314) 577-5100
Contains the Center for Plant Conservation.
Major botanical garden features more than
5000 species of plants on 75 acres.

NEVADA

Desert Demonstration Garden
Las Vegas (702) 258-3205
2 1/2 acres, low-water demonstration garden.

Ethel M Botanic Garden
Henderson (702) 458-8864
2 acres, featuring dry-climate garden.

University of Nevada Las Vegas
Arboretum
Las Vegas (702) 739-3392
This arboretum features a xeriscape
demonstration garden.

NEW JERSEY

Cora Hartshorn Arboretum and
Bird Sanctuary
Short Hills (201) 376-3587
On 16.5 acres along a glacial moraine,
there are also nature exhibits and educational
programs.

George Griswold Frelinghuysen
Arboretum
Morristown (201) 285-6166
127 acres of gardens as well as many trees and
shrubs, the arboretum also contains a fine library.

NEW MEXICO

Albuquerque Xeriscape Garden
Albuquerque (505) 857-8650
A demonstration garden.

Bosque del Apache National Wildlife
Refuge Visitor's Center
Socorro (505) 835-1828
This facility is landscaped with nativeplants. Physical
Plants Department
University of New Mexico
Albuquerque (505) 277-2421
Contains many species of desert and
semi-tropical plants.

NEW YORK

Bayard Cutting Arboretum
Oakdale (516) 581-1002
Naturalistic landscape, wildflower gardens.

New York Botanical Garden
Bronx Park (212) 220-8728
One of the largest botanical collections in the
world, including numerous native plants and
a research library.

NORTH CAROLINA

Blomquist Garden of Native Plants
Durham (919) 684-3698
Part of Duke University, 55 acres, woodland
and other gardens.

Botanical Gardens at Asheville
Asheville (704) 252-5190
10 acres, native plants in natural setting.

North Carolina Botanical Garden
University of North Carolina
Chapel Hill (919) 967-2246
300 acres, contains a fine collection of
indigenous trees, shrubs, and flowers

of the south-eastern states.

North Carolina State University Arboretum
Raleigh (919) 737-3133
8 acre arboretum contains many rare and unusual plants.

OHIO

Chadwick Arboretum
Ohio State University
Columbus (614) 422-9775
Operated by the Department of Horticulture.

Holden Arboretum
Mentor (216) 946-4400
North America's largest arboretum.
3,100 acres, display gardens of woody plants and wildflowers.

Toledo Botanical Garden
Toledo (419) 536-8365
60 acres, native gardens.

OKLAHOMA

U.S. Southern Great Plains Field Station
Woodward (405) 256-7449
Contains many species of trees, shrubs, and wildflowers

Will Rogers Park and Horticultural Garden
Oklahoma City (405) 943-3977
30 acres with over 1000 kinds of plants

OREGON

Berry Botanic Garden
Portland (503) 636-4112
6 acres, featuring collections of Pacific Northwest natives including rare and threatened plants

PENNSYLVANIA

Bowman's Hill Wildflower Preserve
Washington Crossing (215) 862-2924100 acres, recreated Pennsylvania habitats.

Brandywine River Museum and Conservancy
Chadds Ford (215) 388-2700
Features include wildflower gardens and river walk.

Longwood Gardens
Philadelphia (215) 388-6741
Considered one of the greatest gardens in North America with over 12,000 species of plants on 700 acres and an extensive educational program.

SOUTH CAROLINA

Clemson University Horticultural Gardens
Clemson University, Clemson (803) 656-3403
70-acre garden with over 2200 species with an impressive shrub collection.

Sand Hills Agricultural Research Center
Clemson University, Columbia (803) 788-5700
A Clemson unit that is increasing its focus on backyard habitats, native plants, and butterfly gardens.

TENNESSEE

Memphis Botanic Garden
Memphis (901) 685-1566
88-acre garden includes trees and shrubs of the South and a library.

TEXAS

Armand Bayou Nature Center
Houston (713) 474-2551
This 1,900-acre nature center features Texas coastal prairie, woodland, and bayou.

Chihuahua Desert Visitor's Center
Alpine (915) 837-8370
Desert gardens.

Dallas Arboretum and Botanical Garden
Dallas (214) 327-8263
A 22-acre facility containing Texas and southeastern natives.

Mercer Arboretum and Botanic Gardens
Humble (713) 443-8731
12 developed acres, native plants.

San Antonio Botanical Center
San Antonio (512) 821-5115
33 acres, contains a native Texas area with plants from 3 vegetative regions of the state.

UTAH

Utah Botanical Gardens
Farmington (801) 451-3204
Contains a native landscape demonstration garden.

VIRGINIA

Norfolk Botanical Gardens
Norfolk (804) 855-0195
175 acres of gardens with over 7000 species.
Officially certified by National Wildlife Federation's Backyard Wildlife Habitat Program.

WASHINGTON

Washington Park Arboretum
Seattle (206) 543-8800
156-acre arboretum has over 5000 species of plants.

WISCONSIN

Alfred L. Boerner Botanical Gardens
Hales Corner (414) 425-1132
13000 species represented in many communities,
including a prairie garden.

Schlitz Audubon Center
Milwaukee (414) 352-2880
Center features 6 miles of trails, woodland
and prairie.

University of Wisconsin Arboretum
Madison (608) 262-2746
1200 acres with 2000 species,
including restored tall-grass prairie
and woodland.

VII. RECOMMENDED LITERATURE & SOURCES CONSULTED:

* Recommended literature adapted from Taylor's Guide to Natural Gardening, Houghton Mifflin Company, 1993.

NATIVE PLANT LANDSCAPING (GENERAL)

Diekelmann,John and Robert Schuster. *Natural Landscaping: Designing with Native Plant Communities*. New York: McGraw Hill, 1982.

Holmes, Roger ed. *Taylor's Guide to Natural Gardening*. Boston: Houghton Mifflin Company, 1993.

Leighton, Phoebe et al. *The New American Landscape Gardener*. Emmaus, PA: Rodale Press, 1987.

The National Wildflower Research Center. *The National Wildflower Research Center Wildflower Handbook*. Stillwater, MN: Voyageur Press, 1992.

Soil and Water Conservation Society. *Sources of Native Seeds and Plants*. 7515 Northeast Ankeny Road, Ankeny, IA 50021. 1993 version is $6.50 plus $3.50 shipping and handling.

Wilson, William. *Landscaping with Wildflowers and Native Plants*. San Francisco: Ortho Books, 1985.

NATIVE PLANT LANDSCAPING (REGIONAL INFORMATION)

*Regions are based on areas where plants experience similar growing conditions.

Western Mountains and Pacific Northwest

Feeney ,Stephanie. *The Northwest Gardeners' Resource Directory*. Cedarcroft Press, 59 Strawberry Pt., Bellingham, WA 98226.

Grant, John A. and Carol L. Grant. *Trees and Shrubs for Pacific Northwest Gardens*, 2nd ed. Portland: Timber Press, 1990.

Hitchcock, C. Leo and Arthur Cronquist. *Flora of the Pacific Northwest: An Illustrated Manual.* Seattle: University of Washington Press, 1973.

Kruckeberg, Arthur. *Gardening with Native Plants of the Pacific Northwest: an Illustrated Guide*. Seattle: University of Washington Press, 1989.

Orr, Robert and Margaret. *Wildflowers of Western America*. New York: Chanticleer Press, 1981.

Porsild, A.E.. *Rocky Mountain Wild Flowers*. Ottawa: National Museums of Canada, 1979.

Second Interim International Rock Garden Plant Conference. *Rocky Mountain Alpines*. Portland, OR: Timber Press, 1986.

California

Connelly, Kevin. *Gardener's Guide to California Wildflowers*. Sun Valley, CA: Theodore Payne Foundation, 1991.

Emery, Dara. *Seed Propagation of Native California Plants*. Santa Barbara: Santa Barbara Botanic Garden, 1988.

Holmes, Roger and Rita Buchanan, eds. *Taylor's Guide to Gardening in the Southwest*. Boston: Houghton Mifflin, 1992.

Lenz, Lee W. and John Dourley. *California Native Trees and Shrubs for Garden and Environmental Use in Southern California*. Claremont, CA: Rancho Santa Ana Botanic Garden, 1981.

Schmidt, Marjorie. *Growing California Native Plants*. Berkeley: University of California Press, 1980.

Eastern Woodlands

Buchanan, Rita and Roger Holmes, eds. *Taylor's Guide to Gardening in the South*. Boston: Houghton Mifflin, 1992.

Duncan, Wilbur H. And Leonard E. Foote. *Wildflowers of the Southeastern United States*. Athens, GA: University of Georgia Press, 1975.

Flint, H. L.. *Landscape Plants for Eastern North America*. New York: John Wiley, 1983.

Midgeley, Jan. *Nursery Sources of Native Plants in the Southeastern U.S.* You can order this book by writing to Jan Midgely, WILDFLOWER, 23 Oak Tree Trail, Wilsonville, AL 35186.

Snyder, Leon C. and Richard T. Issacson. *Native Plants for Northern Gardens*. Minnesota: Anderson Horticultural Library, University of Minnesota Libraries,Minnesota Landscape Arboretum, 1991.

Coastal Plain

Brown, C. L. and L. K. Kirkman. *Trees of Georgia and Adjacent States*. Portland: Timber Press, 1989.

Foote, Leonard E. and Samuel B. Jones, Jr. *Native Shrubs and Woody Vines of the Southeast Landscaping Uses and Identification*. Portland, OR: Timber Press, 1989.

Halfacre, R. C. and A. R. Shawcroft. *Landscape Plants of the Southeast*. Raleigh, N.C.: Sparks Press, 1989.

Midgeley, Jan. *Nursery Sources of Native Plants in the Southeastern U.S.* You can order this book by writing to Jan Midgely, WILDFLOWER, 23 Oak Tree Trail, Wilsonville, AL 35186.

Great Plains

Art, H. W. *The Wildflower Gardener's Guide: Midwest, Great Plains, and Canadian Prairies Edition*. Pownal, VT: Storey Communications, 1991.

Barr, Claude A. *Jewels of the Plains: Wildflowers of the Great Plains Grasslands and Hills*. Minneapolis: University of Minnesota Press, 1983.

Pauly, Wayne. *How to Manage Small Prairie Fires*. Madison, WI: Dane County Environmental Council, 1985. Available from Dane County Parks Dept., 4318 Robertson Rd., Madison, WI 53714.

Wasowski, Sally and Andy Wasowski. *Native Texas Plants: Landscaping Region by Region*. Austin, TX: Texas Monthly Press, 1988.

Weaver, J. E. *North American Prairie*. Lincoln, NE: Johnsen Publishing Co., 1954.

Western Deserts

Benson, Lyman and Robert A. Darrow. *Trees and Shrubs of Southwestern Deserts*. Tuscon: University of Arizona Press, 1981.

Knopf, Jim. *The Xeriscape Flower Gardener: A Waterwise Guide for the Rocky Mountain Region*. Boulder: Johnson Books, 1991.

Phillip, Judith. *Southwestern Landscaping with Native Plants*. Sante Fe: Museum of New Mexico Press, 1987.

Taylor's Guide to Water-Saving Gardening. Boston: Houghton Mifflin, 1990.

ENVIRONMENTALLY-SOUND LANDSCAPING

Balmori, Diana, Herbert F. Bormann, and Gordon T. Geballe. *Redesigning the American Lawn: A Search For Environmental Harmony*. New Haven: Yale University Press, 1993.

Ellefson, Connie, Tom Stephens, and Doug Walsh. *Xeriscape Gardening: Water Conservation For the American Landscape*. New York: Macmillan Publishing Company, 1992.

Marshall Bradley, Fern, and Barbara W. Ellis, eds. *Rodale's All New Encyclopedia of Organic Gardening*. Pennsylvania: Rodale Press Inc., 1992.

The Organic Way to Plant Protection, 6th ed. Pennsylvania: Rodale Press, Inc., 1966.

Pleasant, Barbara. *The Gardener's Bug Book*. Pownal, VT: Storey Communications, Inc., 1994.

Taylor's Guide to Water-Saving Gardening. Boston: Houghton Mifflin, 1990.

Walters, James and Balbir Backhaus. *Shade and Color with Water-Conserving Plants*. Portland: Timber Press, 1992.

Yepson, Jr., Roger E. *The Encyclopedia of Natural Insect and Disease Control*. Emmaus, PA: Rodale Press, 1984.

Yepson, Roger B., ed. *Organic Plant Protection*. Pennsylvania: Rodale Press, Inc., 1976.

URBAN LANDSCAPING

Patrick, John. *Trees for Town and City Gardens*. Portland: ISBS, 1990.

Yang, Linda. *The City Gardener's Handbook: From Balcony to Backyard*. New York: Random House, 1990.

LANDSCAPING FOR WILDLIFE

Ajilvsgi, Geyata. *Butterfly Gardening for the South.*Dallas: Taylor Publishing, 1991.

Cress, Stephen. *The Audubon Society Guide to Attracting Birds*. New York: Scribner's, 1985.

DeGraaf, Richard M. and Gretchin Witman. *Trees, Shrubs and Vines for Attracting Birds: A Manual for the Northeast.* Massachusetts: University of Massachusetts Press, 1981.

Schneck, Marcus. *Butterflies: How to Identify and Attract them to your Garden*. Emmaus, PA: Rodale Press, 1990.

Swandale, Phillip and David Mason. *The Complete Book of the Water Garden*. New York: Overlook Press, 1990.

HOW TO GROW WILDFLOWERS AND NATIVE PLANTS

Bir, Richard. *Growing and Propagating Showy Native Woody Plants*. Chapel Hill, NC: University of of North Carolina Press, 1992.

New England Wild Flower Society. *Meadows and Meadow Gardening*. Framingham, MA: New England Wild Flower Society, 1990.

New England Wild Flower Society. *Native Plants for Woodland Gardens: Selection, Design and Culture*. Framingham, MA: New England Wild Flower Society, 1986.

Pierot, Suzanne. *What Can I Grow In the Shade?* New York: Liveright, 1977.

Plumridge, Jack. *How to Propagate Plants*, 2nd ed. Portland: ISBS, 1989.

Sullivan, G. A. and R. H. Daley. *Directory to Resources on Wildflower Propagation.*St. Louis: National Council of State Garden Clubs, 1981.

Young, James A. and Cheryl Young. *Collecting, Processing and Germinating Seeds of Wildland Plants*. Portland: Timber Press, 1986.

PROJECT WILD NATIONAL OFFICE

Title: *WILD School Sites - A Guide to Preparing for Habitat Improvement Projects on School Grounds*
Organization: Project WILD
Author: Paul Schiff, Dr. Cindi Smith-Walters
Pages: 64
Date Published: 1994
Cost: $5.00
Contact:

Project WILD
5430 Grosvenor Lane, Suite 230
Bethesda, MD 20814-2142
for order form see http://eelink.umich.edu/wild
tel: 301-493-5447

Description: The purpose of this publication is to help students and teachers take responsible action to improve their communities for people and wildlife - beginning on their school grounds. Discusses planning, team building, implementing and provides examples of school site enhancement projects. Not specific to any geographic region.

Title: *TAKING ACTION: An Educators Guide to Involving Students in Environmental Action Projects*
Organization: Council for Environmental Education, Project WILD
Author: Darlene K. Stoner
Pages: 80
Date Published: 1991
Cost: $7.00 plus shipping and handling
Contact:

Project WILD
5430 Grosvenor Lane, Suite 230
Bethesda, MD 20814-2142
E-mail: natpwild@igc.apc.org
URL: http://eelink.umich.edu/wild/

Description: The purpose of *Taking Action* is to inspire ideas and provide models for conducting effective environmental projects -- projects that dynamically engage students from start to finish. This guide will help educators plan, implement, and evaluate environmental action projects. It includes rationale for action, step-by-step planning process, educational tips and a bibliography and resource list for more information. Samples of more than 30 projects from around the country are included. This guide was developed in cooperation with the World Wildlife Fund.

FLORIDA

Title: *Handbook to Schoolyard Plants and Animals of North Central Florida*
Organization(s): Bingham Environmental Education Foundation; The Nongame Wildlife Program; Florida Game and Fresh Water Fish Commission
Author: Peter Feinsinger and Maria Minno
Date Published: not given
Pages: 128
Cost: $3.00 + $1.50 shipping, make checks payable to *The Nongame Wildlife Trust Fund*
Contact:

Nongame Education Section
Florida Game and Fresh Water Fish Commission
620 South Meridian Street
Tallahassee, FL 32399-1600

Description: A guide for elementary school teachers or anyone else seeking subjects for hands-on investigations into ecological sciences, outdoor biology, and natural history. Specific to North-Central Florida. Includes bibliography.

MINNESOTA

Title: *Landscaping for Wildlife*
Organization: Minnesota Department of Natural Resources
Author: Carroll Henderson
Pages: 138
Date Published: 1994
Cost: $10.95
Contact:
Minnesota's Bookstore
117 University Avenue
St. Paul, MN 55155
Tel: 612-297-3000, 1-800-657-3757

Description: Revised, spiral-bound edition of our best-selling guide to landscaping your property to attract wildlife. This book offers easy-to-follow, affordable landscape plans specifically created for the Midwest climate. Attract everything from butterflies to hummingbirds, cardinals to wood ducks and deer. Features 185 color photos and numerous diagrams and charts.

Title: *Woodworking for Wildlife*
Organization: Minnesota Department of Natural Resources
Author: Carroll Henderson
Pages: 138
Date Published: 1994
Cost: $9.95
Contact:
Minnesota's Bookstore
117 University Avenue
St. Paul, MN 55155
Tel: 612-297-3000, 1-800-657-3757

Description: Revised and expanded in 1992, Woodworking for Wildlife is now full-color and spiral bound. Features numerous diagrams for building shelters for birds and mammals. Includes plans for the Peterson bluebird house, bat houses, platforms for the great horned owl, wood duck nest boxes, and more. Offers information on 50 species of birds and mammals.

Title: *Wild About Birds: The DAR Bird Feeding Guide*
Organization: Minnesota Department of Natural Resources
Author: Carroll Henderson
Pages: 288
Date Published: not given
Cost: $19.95
Contact:
Minnesota's Bookstore
117 University Avenue
St. Paul, MN 55155
Tel: 612-297-3000, 1-800-657-3757

Description: Provides techniques used by the author to double the number of species using his feeders. Includes woodshop basics for construction of 26 difference feeders and tips on 44 types of food, plus detailed descriptions and photos of almost all the feeder-using species east of the Rocky Mountains - 69 in all. There's even a section on some of the unusual and unexpected wild visitors that may show up for a free meal. Over 425 color photographs, illustrations and diagrams make this a great reference manual, display book or gift. Ideal for the ornithologist, woodworker, or backyard birdwatcher. Spiral bound.

Title: *Minnesota School Nature Areas: Notes on Benefiting the Biomes*
Organization: School Nature Area Project
Author: Matt Nielsen and the School Nature Area Project
Pages: 46
Date Published: 1996
Cost: $ 5.00
Contact:
Send check to :
School Nature Area Project
1520 St. Olaf Ave.
Northfield, MN 55057
tel: 507-646-3599
Description: Provides background information and resources on Minnesota's three major biomes, prairie, coniferous forest, and deciduous forest. Aquatic communities are also highlighted. Also looks at how the landscape has changed since European settlement and gives guidelines for planning and creating school nature areas.

Title: *Homes for Wildlife*
Organization: School Nature Area Project
Author: written and edited by Marilyn Wyzga, edited for Minnesota by the School Nature Area Project
Pages: 225
Date Published: 1995 in Minnesota
Cost: $ 10.00
Contact:
Send check to :
School Nature Area Project
1520 St. Olaf Ave.
Northfield, MN 55057
tel: 507-646-3599
Description: The New Hampshire publication, *Homes for Wildlife*, provides concrete information and practical applications for enhancing schoolyards for wildlife. SNAP edited this resource to include background information and resources related to Minnesota's three major biomes.

NEW HAMPSHIRE

Title: *Homes for Wildlife*
Organization: New Hampshire Fish and Game Department
Author: written and edited by Marilyn C. Wyzga
Pages: 225
Date Published: 1993
Cost: $8
Contact:
Send check to:
New Hampshire Fish and Game Department
Attn: Business Division
2 Hazen Drive
Concord NH 03301
tel: 603-271-3211
Description: As the Project WILD curriculum has become more popular and widely used, teachers have been requesting more specific, concrete information and practical applications for enhancing their schoolyards for wildlife, and for creating outdoor classroom sites. In response, we have developed Project HOME - Habitat: Opportunities for Management and Education. This guide provides a step-by-step procedure for assessing and mapping the schoolyard property, developing a plan and implementing enhancement projects, with supplementary information to support the effort and make it a success. All information is geared toward grades K-6, with developmentally appropriate activities for each age group. Includes a bibliography of other resources.

OREGON

Title: *Naturescaping - A Place for Wildlife*
Organization: Oregon Department of Fish and Wildlife
Author: Weston, Shann
Pages: ~200
Date Published: 1992
Cost: $10 (includes shipping)
Contact:

Information and Education Office
Naturescaping Book
Oregon Department of Fish and Wildlife
Box 59
Portland OR 97207
State:Oregon
Tel: 503-872-5264

Description: Provides detailed information on how to landscape for the benefit of wildlife. Includes plant lists specific to the Pacific Northwest and detailed plans for feeders and nest boxes.

PENNSYLVANIA

Title: *Native Plants in the Creation of Backyard, Schoolyard, and Park Habitat Areas*
Organization: Audubon Council of Pennsylvania
Author: Marci Mowery
Date Published: 1996
Cost: $7.00
Contact:

Marci Mowery
Audubon Council of Pennsylvania
1104 Fernwood Avenue, Suite 300
Camp Hill, PA 17011
717-763-4985

SOUTH DAKOTA

Title: *Sharing Your Space - A Homeowner's Guide To Attracting Backyard Wildlife*
Organization: South Dakota Department of Game, Fish and Parks
Author: Eileen Dowd Stuckel, Douglas C. Backlund, Maggie E. Hachmeister, and Terry Wright
Pages: 111
Date Published: 1995
Cost: free
Contact:

South Dakota Department of Game, Fish and Parks
Information Office
523 East Capital
Pierre, SD 57501
URL: http://www.state.sd.us/gfp/

Description: This book is designed as a practical, easy-to-use guide to attracting wildlife to a yard or small acreage in South Dakota. This source can help you select the appropriate plants and other features to fulfill wildlife needs for food, water, shelter, and space. When those elements are in place, wildlife will find you.

UTAH

Title: *Creating Landscapes for Wildlife - A Guide for Backyards in Utah*
Author: Sue Nordstrom
Pages: 32
Date Published: 1991
Cost: call to inquire
Contact:
Project WILD Office
UT Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116-3195
tel: 801-538-4720
fax: 801-538-4709
Description: Provides guidelines for habitat enhancement, geared towards residental backyards. Includes specific information on Utah plants, wildlife, and ecosystems

VIRGINIA

Title: *Gardening for Wildlife*
Organization: Virginia Museum of Natural History
Pages: 53
Date Published: 1993
Cost: call to inquire
Contact:
Virginia Museum of Natural History
1001 Douglas Ave
Martinsville, VA 24112
tel: 540-666-8600
Description: This joint program was developed by the Virginia Museum of Natural History and the VA Dept of Game and Inland Fisheries. The hands on program will provide your school with the training and materials to inventory, design, create, and use a school yard garden that will fit into your existing curriculum.

WASHINGTON, D.C.

Title: *Chesapeake Bay Community Action Guide: A Step by Step Guide to Improving the Environment in Your Neighborhood*
Organization: Metropolitan Washington Council of Governments, Department of Environmental Programs
Pages:
Date Published: 1994
Cost: Free (Pub. # 94705)
Contact:
Metropolitan Washington Council of Governments, Department of Environmental Programs
777 North Capital Street, NE
Washington, D.C. 20002
202-962-3256
Description: A step-by-step guide to improving the environment in your neighborhood including wetland planting suggestions, reforestation tips, stream cleanups, native plant guide, and a list of local resources.

WISCONSIN

Title: *Prairie Restoration for Wisconsin Schools*
Organization: University of Wisconsin - Madison Arboretum
Author: Molly Fifield-Murray
Pages: 100
Date Published: 1993
Cost: $20.00 plus $3.00 shipping and handling
Contact:

University of Wisconsin - Madison Arboretum
1207 Seminole Highway
Madison, WI 53711
608-262-5522

Description: A "how-to" manual that includes prairie history, ecology, wildlife, curriculum ideas, and sources of native prairie seeds and plants. This book is in the process of being expanded to include information for Minnesota and Iowa.

CANADA

Title: *Habitat Restoration: A Guide for Proactive Schools*
Organization: Waterloo County Board of Education
Author: Edward D. Cheskey
Pages:
Date Published: 1993
Contact:
Description: This guide is based on work with schools in Toronto. It includes information and tips on natural communities; design considerations; plant materials; project specifics for ponds, prairies, and forests; organization and planning issues; and resources.

Title: A Guide to Schoolyard Naturalization
Organization: The Evergreen Foundation
Author: na
Pages: 37
Date Published: 1994
Contact:

Prentice Hall Canada, Inc.
1870 Birchmont Road
Scarborough, Ontario M1P 2J7
800-567-3800, or fax 416-293-5646

Description: An overview for creating naturalization projects, from benefits, to plans, to designs and implementation, and finally maintenance. Describes a variety of habitat types and suggests a variety of projects. Also includes suggestions for connecting with the curriculum. Black and white photographs, diagrams, line drawings, and appendices.

Miscellaneous

Title: *The Field Guide to Wildlife Habitats* (two volumes, Eastern and Western United States)
Organization: Simon and Schuster
Author: Janine M. Benyus
Date Published: 1989
Pages: each 336 pp.
Cost:$14.95
Contact:

Fireside Books
Simon and Schuster Building

Rockefeller Center
1230 Avenue of the Americas
New York, NY 10020

Description: Two excellent and readable guides, very accessible. Includes definition of habitat, observation tips, and profile of each habitat, with charts, illustrations, maps, and keys, and specific information on individual species.

Title: *Research and Management Techniques for Wildlife and Habitat*
Organization:
Author: T. A. Bookhout
Date Published: 1994
Pages: 740
Cost: $40.00
Contact:
The Wildlife Society
5410 Grosvenor Lane, Suite 200
Bethesda, MD 20814
301-897-9770
Description: The most comprehensive textbook for wildlife and their habitats.

Title: *Providing Wetlands for Wildlife While Controlling Stormwater*
Organization: Pennsylvania State University, College of Agricultural Sciences Cooperative Extension
Author: Margaret Brittingham
Cost: single copies FREE
Contact:
Publication Distribution Center
Pennsylvania State University
112 Agricultural Administration Building
University Park, PA 16802
814-865-6713

Title: *A Citizen's Streambank Restoration Handbook*
Organization: Save Our Streams Program, Izaak Walton League of America, Inc.
Author: Karen Firehook and Jacqueline Doherty
Date Published: 1995
Pages: 111
Cost: $15.00
Contact:
Izaak Walton League of America, Inc.
707 Conservation Lane
Gaithersburg, MD 20878
1-800-284-4952
Description: A 111 page guide to restoring eroding stream banks using vegetation. Case studies, sample budgets, and tips for choosing the best solution for your stream are included.

Title: *Volunteers Teaching Children*
Organization: NAAEE
Author: Karen S. Hollweg
Date Published: 1995
Pages: 213
Cost: $17.00 plus $2.50 shipping and handling for non-NAAEE members
$13.50 plus $2.50 shipping and handling for NAAEE members
Contact:
NAAEE Publications & Membership Office
P.O. Box 400
Troy, OH 45373

Phone/Fax: 513-676-2514

Description: This guide is based on the experience of the Denver Audubon Society in establishing its Urban Education Project and the subsequent experiences of people in seven other cities as they established similar programs. This program manual, along with 2 videos, 5 investigations and 30 magnifying lenses are sold together in the *VINE Start-Up Kit.* ($66.50 plus $4.50 shipping and handling for non-NAAEE members and $56.50 plus $4.00 shipping and handling for NAAEE members.)

Title: *WOW! The Wonders of Wetlands*
Organization: Environmental Concern, Inc. And the Watercourse
Author: Alan S. Kesselheim, Britt Eckhardt Slattery, Susan H. Higgins, and Mark R. Schilling
Date Published: 1995
Pages: 330
Cost:$15.95 plus $4.50 for shipping and handling
Contact:

Environmental Concern, Inc.
P.O. Box P
Saint Michaels, MD 21663
410-745-9620

Title: *Living with Wildlife*
Organization: The California Center for Wildlife, 76 Albert Park Land, P.O. Box 150957, San Rafael, CA 94915-0959
Author: Diane Landau and Shelley Stump
Date Published: 1994
Pages: 342
Cost: $15.00
Contact:

Sierra Club Books, San Francisco, CA

Description: How to enjoy, cope with, and protect North America's wild creatures around your home and theirs. Discussion of sharing space with wildlife and relationships between wildlife and humans. Specific reference guide to North America wildlife (by species group), possible conflicts with particular species, and suggested resolutions.

Title: *American Wildlife and Plants: A Guide to Wildlife Food Habits*
Organization: Dover Publications
Author: Alexander C. Martin, Herbert S. Zim, and Arnold L. Nelson
Date Published: 1951
Pages: 518
Cost:$9.95
Contact:

Dover Publications, Inc.
180 Varick Street
New York, NY 10014

Description: Accessible information in field guide format with range maps and line-illustrations of species, describing how birds and mammals make use of trees, shrubs, and weeds. Index cross-referenced to wildlife species and vegetation types.

Title: *The Great Outdoors: Restoring Children's Right to Play Outside*
Organization: National Association for the Education of Young Children
Author: Mary S. Rivkin
Date Published: 1995
Pages: 106
Contact:

National Association for the Education of Young Children
1509 16th Street NW
Washington, D.C. 20036-1426

Description: Mary Rivkin sounds the call for schools and comunities to restore children's outdoor play opportunities. The book gives inspiring examples of play spaces across the United States and the world, and offers practical ideas for bringing the great outdoors to every school. Black and white photographs and diagrams. Appendices include bibliography and resource lists for learning through landscapes.

Title: *Backyard Wildlife Garden*
Organization: Rodale Press
Author: Marcus Schneck
Date Published: 1992
Pages: 160
Cost: $24.95
Contact:

Rodale Press Book Readers' Service
33 East Minor Street
Emmaus, PA 18098

Description: This covers how to attract and identify wildlife in your yard. Includes discussion on creating the environment, with specific directions for working with habitat types and providing habitat for specific species types in different regions of the country. Also recommends techniques for identification and observation, and an introduction to backyard species. Beautiful color photographs and water color illustrations; many lists, charts, and diagrams.

Title: *Water Gardens*
Organization: Barron's Educational Series, Inc.
Author: Peter Stadelmann
Date Published: 1992
Pages: 143
Cost:$14.95
Contact:

Barron's Educational Series, Inc.
250 Wireless Boulevard
Hauppauge, NY 11788

Description: Expert advice and practical instructions and ideas for streams, pools, and water gardens. Illustrated with 150 color photographs. Provides background on ponds ad pond models, directions for building ponds and pools, and information on animals, plants, an d upkeep.

Title: *The Butterfly Book*
Organization: Little, Brown and Co.
Author: Donald and Lilian Stokes with Ernest Williams
Date Published: 1991
Pages: 96
Cost:$11.95
Contact:

Little, Brown and Co., Boston, MA

Description. An easy guide to butterfly gardening, identification and behavior. Color photographs, and descriptions of 9 families and over 50 species of butterflies. Complete list, with range maps, of vegetation recommended for attracting butterflies in larval and adult stages.

Title: *The Bird Feeder Book*
Organization: Little, Brown and Co.
Author: Donald and Lillian Stokes
Date Published: 1987
Pages: 88
Cost: $8.95
Contact:

Little, Brown and Co., Boston, MA

Description: Another in the terrific series by the Stokes. Guidelines on attracting more birds to your yard, identifying species, and understanding bird behavior at feeders. Includes field guide to common species, color photographs, illustrations of feeder designs, and range maps. Also includes a bird feeder journal for recording sightings. Recommends how to provide for bird habitat needs, and how to troubleshoot specific problems at feeders.

Title: *Wetland Planting Guide for the Northeastern United States*
Organization: Environmental Concern, Inc.
Author: Gwendolyn Thunhorst
Date Published: 1993
Pages: 179
Cost:$19.95 plus $3.00 for shipping and handling
Contact:
Environmental Concern, Inc.
P.O. Box P
Saint Michaels, MD 21663
410-745-9620

The following publications were researched but are NOT readily available:

FLORIDA

Title: *The Schoolyard Wildlife Activity Guide*
Organizations: Nongame Wildlife Program; Florida Game and Fresh Water Fish Commission
Author: Linda Cronin-Jones
Pages: 210
Date: 1992
Availability: Not available to general public. (available through workshops only)

Title: Florida's Water Resource Activity Pack- A Supplement to *The Schoolyard Wildlife Activity Guide*
Organization: Southwest Florida Water Management District; South Florida Water Management District
Author: Linda Cronin-Jones
Pages: 74
Date:
Availability: Not available to general public. (available through workshops only)

Title: *Schoolyard Ecosystems for Florida - A Guide for Planning, Installing, Maintaining, and Using*
Organization: University of Florida
Author: Joseph M. Schaefer, Dan W. Donelin, Linda Cronin-Jones
Pages: 188
Date: 1995
Availability: Not available to general public. (available through workshops only)

Title: *Schoolyard Ecosystems for Northeast Florida*
Organization: University of Florida
Author: Joseph M. Schaefer, Dan W. Donelin, Lester L. Linscott, Linda Cronin-Jones
Pages: ~90
Availability: Out of print (now incorporated into *Schoolyard Ecosystems for Florida*

NORTH CAROLINA

Title: *North Carolina WILD Education Sites Landscape Plans*
Organization: Division of Conservation Education, NC Wildlife Resources Commission
Availability: Only to participants of NC WILD Education Sites Program.

Additional References:

Art, Henry W. *The Wildflower Gardener's Guide*. 180 pp. Storey Communications, Inc. Pownal, VT. ISBN # 0-88266-439-5 paper, 0-88266-450-6 cloth. 1995.

Brooklyn Botanical Garden Booklets: *Going Native: Biodiversity in Our Own Backyards*. Ed. Janet Marinelli. 1994.

Cronin, William. *Changes in the Land: Indians, Colonists, and the Ecology of New England*. Wm. Cronin, Hill and Wang, NY. 1983.

Dennis, John and Matthew Tekulsky. *How to Attract Hummingbirds and Butterflies*. 112 pp. Ortho Information Services. 1991.

Druse, Ken. *The Natural Habitat Garden*. 248 pp. Clarkson N. Potter, Inc., NY. ISBN# 0-517-58989-3. 1994.

Leopold, Aldo. *A Sand County Almanac*. Ballantine Books, New York, New York. 1949.

Kress, Stephen W. *The Bird Garden*. 176 pp. Dorling Kindersley. 1995.

Pond Watchers, Guide to Ponds and Vernal Pools of Eastern North America. Massachusetts Audubon Society, Lincoln, Massachusetts. 1995.

Stein, Sarah. *Noah's Garden, Restoring the Ecology of Our Own Back Yards*. 256 pp. Houghtin Mifflin Company, New York, New York. 1993.

Tufts, Craig and Peter Loewer. *The National Wildlife Federation's Guide to Gardening for Wildlife*. 192 pp. Rodale Press. 1995.

Wilson, William H. *Landscaping with Wildflowers and Native Plants*. 96 pp. Ortho Information Services. 1985.

Title: How to be a Good VINE Volunteer
Organization: North American Association for Environmental Education (NAAEE)
Producers: prod. and written by Karen Hollweg and Wily Squid Productions -- Joy Cohen and Stu McGowan
Length: 18 minutes
Date Produced: 1994
Cost: $13.50 plus $2.50 shipping and handling
$12.50 (for NAAEE members) plus $2.50 shipping and handling
Contact:

NAAEE Publications & Membership Office
P.O. Box 400
Troy, OH 45373
phone/fax: 513-676-2514

Description: This 18 minute video is a super tool for training teen and/or adult volunteers. It highlights the volunteer's role at each point in an activity, shows an experienced volunteer as she conducts an entire investigation with a group of youngsters, and gives tips for actively engaging kids and working with them.

Title: Volunteer-led Investigations of Neighborhood Ecology: VINE Programs in Action
Organization: North American Association for Environmental Education (NAAEE)
Producers: prod. and written by Karen Hollweg and Wily Squid Productions -- Joy Cohen and Stu McGowan
Length: 6 minutes
Date Produced: 1994
Cost: $10.00 plus $2.50 shipping and handling
$9.00 (for NAAEE members) plus $2.50 shipping and handling
Contact:

NAAEE Publications & Membership Office
P.O. Box 400
Troy, OH 45373
phone/fax: 513-676-2514

Description: This 6 minute video introduces VINE programs from the perspectives of project coordinators and participants in several different cities. Live footage enables you to join youngsters as they engage in outdoor learning experiences right in their own neighborhoods.

Title: Habitat Forming (one of a 32 set series)
Organization: Environmental Media Inc.
Producers: KQED - TV San Francisco
Length: 5 minutes
Date Produced: 1994
Cost: $14.95 (ISBN# 1-56791-184-6) plus $4.00 shipping and handling
Contact:

Environmental Media Corporation
P.O. Box 99
Beaufort, SC 29901-0099
phone: 800-368-3382
fax: 803-986-9093

Description: For Steve Packard, science director of the Illinois chapter of The Nature Conservancy, "green" means that environments once thought to be lost can be resurrected. When Packard realized that a typical midwestern prairie field in the Northbrook suburb of Chicago was once a grassland home to oak trees and unique varieties of wildflowers, hawks, bluebirds, and butterflies, he swung into action. He tells us how he painstakingly tracked down the few remaining examples of indigeniousplant life and reintroduced them to the prairie.

Title: Nature Scaping: A Landscape Alternative
Organization: Public Production Group
Producers: Sam Love
Length: 28 minutes
Date Produced: 1992
Cost: $29.95 plus $3.95 shipping and handling
Contact:

Public Production Group
900 Second Street, NE
Washington, DC 20002
202-898-1808

Title: Grounds for Change: Schoolground Naturalization
Organization: The Evergreen Foundation
Producers: prod. & directed by Naomi Robertson
Length: 15 minutes
Date Produced: 1995
Contact:

The Evergreen Foundation
355 Adelaide Street West, #5A
Toronto, ON M5V 1S2
416-596-1495

Title: Exploring School Nature Areas
Organization: Project WILD and the School Nature Area Project (SNAP)
Producers: SNAP and Twin Cities Public Television
Length: 13 minutes
Date Produced: 1994
Cost: $16.00 plus shipping and handling
Contact:

Project WILD
5430 Grosvenor Lane, Suite 230
Bethesda, MD 20814-2142
301-493-5447

Title: Learning Under the Sun School Nature Areas
Organization: School Nature Area Project
Producers: School Nature Area Project and Twin Cities Public Television
Length: 27 minutes
Date Produced: 1994
Contact:

School Nature Area Project
St. Olaf College
1520 St. Olaf Avenue
Northfield, MN 55057
phone: 507-646-3599

Description: Visit School Nature Areas throughout the nation to discover how students, teachers, and their communities are using nature areas to teach about the environment. This program highlights: Site Planning and Development, Curriculum Development, and Minnesota Resources.

Title: Georgia Schoolyard Wildlife Areas
Organization: Georgia Wildlife Federation
Producers: Whoa! Films, Inc.
Length: 15 minutes
Date Produced: 1988
Cost: $9.95 plus $4.17 shipping and handling
Contact:

Georgia Wildlife Federation
1930 Iris Drive
Conyers, GA 30207
404-929-3350

Description: A video designed to introduce persons to the program through touring several Georgia Schoolyard Wildlife Habitats and talking with the educators, parents, students, and community volunteers who mad them happen. The 14 minute video was funded by an Urban and Community Forestry Grant from the Georgia Forestry Commission. Also available for two week loan.

Email: natpwild@igc.apc.org
URL: http://eelink.umich.edu/wild/

Description: This video was produced in cooperation with St. Olaf College's "School Nature Area Project". It is designed to inspire students and educators to take positive action for the environment, and it provides examples of outdoor classrooms around the country.